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THE "INVESTIGATION" AT CLEVELAND, OHIO.

The authorities at Cleveland, O., some months ago, presumably acting under the statutes of the State applicable to such situations, decided that the Companies supplying gas in that city should sell their product at a rate not to exceed 60 cents per 1,000 cubic feet, basing this ordinance on the asserted knowledge and belief that such a price was a reasonable one to all the interests involved. Cleveland at the time enjoyed the distinction of being one of the few cities in the country where gas was sold at $1 per 1,000, and in fact had been held up frequently as an example indicative of the liberality of those in control of her gas interests. Times change, however, and in this revolution or evolution new office holders also come to the surface. So it was in Cleveland, and the newest board of City Fathers, turning their attention to the gas rates, sought, by cutting these largely, to advance themselves in public favor. Of course, to gas men, it is needless to say that gas at 60 cents per 1,000 cubic feet in Cleveland means simply ruin to those engaged in supplying the light—particularly when it is remembered that the quality of Cleveland gas will average not far from 19 candles, and so it will not be necessary to here enter into any explanation of this phase of the matter.

If the authorities who ordered this reduction are to be considered as neither fools nor knaves it is necessary to hold that they were in possession of evidence supporting their position—that they knew to a certainty they were not injuring, and seriously so, the gas suppliers in an honest attempt at benefiting the gas consumer. Well, the facts so far brought out in the case are about like these: In the first place the Council meetings at which the measure was passed were in a measure secret, and the details of the same would warrant the conclusion, to anyone non-resident of Cleveland, that the whole transaction had the complexion of a conspiracy. The Companies were not permitted to show that grave injustice would be done them, and it is a matter of plain record that indecent haste characterized every step of the conspiracy. However, when the time came for the ordinance to be enforced, according to its provisions, the Companies invoked the courts, and in the discussion that ensued it was agreed by the expounders of the law that—the very haste of the conspirators was likely to confound them—the ordinance had not been made out with respect to due commands of the statutes. Not to be baulked of their prey, the committee on ordinances of the Council ordered that an investigation of the wisdom of reducing the gas rate to 60 cents per 1,000 be made.

With every indication of their belief that each Cleveland resident who was in any manner connected with the local gas companies—either as official, shareholder or employee—was a rascal, the Committee issued subpœnas in drag-net fashion, and gave orders that every account book be opened before them. It may have been good policy on the part of the Company's officers, in the main, and at the outset of the investigation, to pay slight attention to these requests, or that when they did appear, to play the part of not knowing anything. This, of course, as to the appropriateness or politics of the stand taken, is not for us to comment on, nevertheless it might have been well to remember that old saw about the flies, the vinegar and the molasses. In any event, the investigation was started, and the chief investigator seemed to be one General Meyer—this General may be entitled to a pension, and if so we would respectfully urge upon him that he apply some of it to obtaining elemen-

tary points in regard to gas and gas making, provided he desires to keep up with the gas procession. The witnesses were few and they seemed to know but little about the Company's affairs, but at last Mr. Ed. Lindsley, formerly in charge of the Cleveland Peoples Gas Light Company as Engineer, was put upon the stand, and as he showed a disposition to speak of things as he found them, our brave General had excellent opportunity to ventilate his density on things gaseous. Having inquired of the witness whether gas was not once sold in Baltimore at 50 cents per 1,000—to which Mr. Lindsley replied that it had been sold there as low as 35 cents per 1,000, while a gas war was on—he followed it by wanting to know why gas could not be sold in Cleveland at the price it was sold in Baltimore. Mr. Lindsley replied it could, which was the fact in that the general price to day in Maryland's big city is $1.25 per 1,000. The General then wanted to know if the price of gas in London was not 48 or 49 cents, if the gas companies in London did not furnish gas to the public lamps free, because they (the companies) "were owned by the city," and so on. No, General, the cheapest gas sold in London just now is supplied as follows:

Company.	Candle Power.	Price per 1,000 Cu. Ft.
The Gas Light and Coke	20	3s. 3d.
" " " "	16	2s. 6d.
Commercial	16	2s. 4d.
South Metropolitan	16	2s. 3d.

The candle power (the first-named Company distributes in one district what is called a cannel gas, and in the balance what is known as common gas) named is that called for in the act, but the Companies usually exceed the stipulation by about one-half candle on the average. The three Companies are as distinctly private corporations as are the two Companies in Cleveland, and the London Companies supply gas to 74,467 public lamps, every foot of which gas supplied is paid for in pounds, shillings, and pence. The further remark would seem to be in order that at the last half-annual meeting of the South Metropolitan Company (held on the 19th of last month) the Directors deplored the necessity which caused them to order that on next Michaelmas day the gas rate be increased to 2s. 6d. per 1,000. Further, these three great Companies supply gas to no less than 310,000 consumers, with an average number of consumers per mile of main equal to 107. Indeed, if General Meyer could only inflate Cleveland to the size of London, Messrs. Morley and Warmington would likely agree to cut their gas schedules a trifle below those now ruling in London, and at the same time give to every consumer a 20 candle gas.

If one may take the ignorance of General Meyer on gas questions as a sample of that which pervades his co conspirators in their attacks on the Cleveland Gas Companies, we must conclude that their 60 cent ordinance was not founded on justice and equity, but rather was the offspring of illusion or malice.

[Since the above was written the "investigation" was ordered closed, and the Council decreed that 60 cents per 1,000 cubic feet was "a reasonable price for gas." A new ordinance has been enacted to that effect.]

NOTES.—The Jacksonville (Fla.) Gas Company lost upwards of $500 because of the meters, etc., destroyed during the recent heavy conflagration at that point.——Mayor Somers has signed the ordinance requiring all electric light wires in Milwaukee to be put underground.

The Market for Gas Securities.

The close of August finds the market in the grasp of those who barter for higher prices. Confidence is in some measure restored and investors seem to be alive to the fact that very many shares have for some time been offering at prices much below their real worth. Such reflections as these, however, have no concern for holders of city gas shares, in that the latter should not be affected by the course of the general share market. The city companies are all doing an excellent business, and they are about to enter on the busy season of 1891-2 in better shape than at any time within the past five years.

Consolidated is strong at 96½ to 98, with but little stock offering. We look for the par mark to be made in it before October first. Equitable and Mutual are steady and strong. The Standard Company has declared a dividend of 1¼ per cent. on the preferred shares, for the quarter ended June 30, which is payable on and after to-morrow to shareholders of record, of August 27th. The transfer books will be reopened on Wednesday next.

In Brooklyn shares no change is reported. Chicago gas is up to 48½-49. Laclede common is stronger at 17⅛ to 17¼, and Bay State is heavy—bidders offer 51 for it while holders ask 58.

The Construction and Working of Regenerative Retort Settings.

[A paper read by Mr. G. Love before the North British Association of Gas Managers.]

On being asked by your President to contribute a paper at this meeting, and considering the various subjects upon which to write, I very naturally resolved to give one on a matter to which I have given considerable attention—viz., the construction and working of regenerative retort settings. On looking over the annual reports of this Association, I find that for the past eight years this question has occupied your attention to a considerable extent, and papers of very great merit have been written on it by gentlemen well qualified to speak on the subject. Their complete description of the Siemens, Klonne, and other systems, presently at work in our midst, will limit my paper (unless I go over old ground) to a description of the construction and working of the regenerative system at the Paisley Gas Works.

The first construction, on a large scale, of Mr. G. R. Hislop's method of regenerative firing was in the spring 1888, previous to this we had several ovens of four retorts at work for a couple of years, the thorough success of which led to a larger construction on the same principle. In one of our retort houses we had two benches of 40 retorts each, working back to back; the chimney being placed between them. These were at work on the open system of firing—two retorts in each oven, with ten ovens on either side, making in all 40 retorts, with 20 fires, per bench. This method of setting was due to the inferior quality of the coke used. In order to give the new system a fair trial it was resolved to take down one bench. In this space we found that eight ovens (four on each side), of eight retorts per oven, could be built—making in all 64 retorts—as compared with only 40 retorts formerly occupying the same space; thus effecting a saving of 66 per cent. of retort house area. The ovens were 8 ft. 6 in. wide by 9 ft. high to the inside of the crown of the arch from the floor line; while to get the proper depth of producer and travel for the regenerators, we had to excavate 5 ft. 10½ in. to the bottom of the foundations. In making these excavations we had to go 3 ft. lower than the foundations of the retort house gable wall; necessitating the underbuilding of it to this extent. This was successfully accomplished—building widths of 3 ft. at a time, putting in wedges well driven up, and, after completion, making a thoroughly safe and substantial job. We have two main flues—one for each side of the bench; and these are started on the top of concrete foundations, with a 14-inch wall between them. Each oven has four outlet ports to the main flue, and is so built as, if necessary, to be easily cleaned through into the main flue from the front of the bench. Formerly our main flue was on the top of the bench, having uptake flues in the center wall of the oven. But by placing the main flue underneath, there is less liability to fracture, no loss of heat by radiation takes place, there are no uptake flues, access is easier for cleaning purposes, and there is a saving in solid brickwork.

The producer and the regenerators are built inside the ovens, and are so constructed as to be taken down separately, if necessary, for repairs, without damage to the other parts. The regenerators are placed on either side of the producer, and are formed of two backing-up tiles—one against the wall of the oven, and the other against the wall of the producer—with vertical division tiles dividing or separating the two flues; the whole space being spanned by one tile. This, however, was found objectionable, as not being easily jointed; and two cheeked tiles were substituted. The secondary air is admitted near the bottom of the sunk chamber, by means of an air-tight sliding-disc arrangement; the air traveling backward and forward five times the full length of the oven—altogether about 30 feet of travel—before entering the combustion chamber. The waste gases from the oven pass down in the opposite direction to the secondary air, and have on the same level as the admission port of the secondary air a down-going port with dampers placed one on either side of the oven, for controlling the draught. Immediately underneath this damper there is an escape port to the chimney; but this port is controlled so that a large proportion of the gases flow down and along underneath water-pans, for the purpose of generating steam—thus saving the supply of steam from a boiler outside, and at the same time more fully abstracting the heat from the waste gases. These pans are made of cast iron, and have a protecting tile underneath. From the side of the regenerators, and passing over the pan, is thrown a curved plate of cast iron, having on the top boxes forming ports for the admission of air and steam to the producer. Inside these plates is the pan chamber. The outside or top of this plate is covered with the side arch brick, forming the sides of the bottom of the producer; and separating these two plates at the bottom is placed a cast iron sole plate, 6½ inches broad. You will thus observe the absence of any movable parts in the furnace. In the front wall of the oven at the pan chambers, and

on a level with the top of the pan, are built cast-iron frames fitted with air tight doors; being faced all over, and having a movable disc arrangement for the admission of air for the supply of the producer. On top of this frame, ½-inch malleable iron tubing is led, for the constant supply of water to the pans.

The sides of the producer are started on top of the curved plates, over which an arch is thrown, with ports through the crown of the arch into the combustion chamber on the top. Between the two bottom retorts, and on the top of the producer, is placed the combustion chamber, the top of which was made a continuous arch, with outlet ports for the gases to the oven; the crown forming the bed for the center retorts. In the front wall of the producer are built two doorways. The top one is formed above the floor line, and used for charging the producer; this process being accomplished by hand. The under one, which is near the bottom of the producer, is to allow of the latter being cleaned out. Covering all is a cast-iron front plate, bolted to which are cast-iron mouths fitted with air-tight doors, having bridles, screws, etc. By this means the producer is kept perfectly air-tight. Spy-blocks are placed in ports carried through the front wall into all the secondary air and waste gas flues. By this means every part is easily got at, and can be cleaned out when necessary. For facility of access to the cleaning door, to the pan chambers, and also to the regenerators, a sunk chamber is formed 8 ft. 10½ in. long from the front of the bench, the same width as the oven, 8 ft. 6 in., by 4 ft. deep; brick steps being built in the back wall for the purpose of getting down and up. The sides of each sunk chamber are formed by the extension of the division walls of the ovens to the back wall of the sunk chamber. These form a rest for the bench-binders, and also at the same time save heavy cross-ties, which otherwise would be necessary to withstand the outward thrust of the bench; thus keeping the entire bottom of the walls thoroughly solid and safe.

The bench-binders, which are formed of two heavy malleable iron plates placed 10 in. apart, and bolted together through distant studs, are let down 2 ft. under the surface of the division walls of the sunk chamber; and bolted to the binders near the floor line is a thin malleable iron pocket, set into a chamber for the purpose of carrying air down into the sunk chamber for the necessary supply of secondary and primary air to the ovens. The sunk chamber is covered at the sides by cast-iron chequered plates being carried by the walls and T-iron bars, while in the center are two hinged doors and a movable plate for the purpose of getting underneath; the whole making a very strong and substantial, and at the same time a comparatively cheap job. The retorts are supported upon six piers 9 in. broad, carried up to the center of the top retorts, having 9 in. spaces between each pier. These piers are formed of special blocks, each made to suit the position on the side of the retorts; thus very much simplifying the building. The blocks, as well as the whole of the brickwork from the top of the producer upwards, have a great percentage of silica in their composition, so as to thoroughly withstand the heat.

The furnaces were first lighted for drying the ovens; and a gradually increasing fire was kept on till this was done. We then commenced firing with four hour charges (these being light). But after a few days' working, these were increased to three hour ones; and very fair heats were obtained. The coke from the two bottom retorts was drawn into low bogies, and charged by hand into the producers; this being found sufficient to maintain the necessary heats. The coke from the other six retorts was drawn into barrows, and taken out of the house to be slaked. The furnaces were cleaned out every twelve hours at this time. In the case of most of the furnaces, we were not very much troubled with clinker, although they were not what we desired. This was owing to the flues under the pans being too narrow, and also to the pans being allowed to run dry. We had also some little difficulty in regulating the primary and secondary air supply, as well as the extent of damper; but these troubles were due to the men slaking the coke before charging the producers. They did this because it was not very easy to throw red-hot coke into the producer. The consequence was that the heats fell considerably after a fresh charge of fuel—showing very decidedly the necessity of charging with red-hot fuel, so as to secure the minimum production of carbonic acid at the outlets of the producer. We experienced some trouble also with the combustion chamber, having at this time only one for each oven. The heat being too much confined, owing to the smallness of the parts, etc., the brickwork melted, and formed large stalactites on the crown of the arch. A portion of it falling in necessitated the putting out of the furnaces, and the repairing of the chamber. Bricks containing 90 per cent. of silica having been procured, the damage was easily rectified (all parts of the work being readily accessible without injury to other parts); the retorts were then relit, and were kept going all the winter, to our complete satisfaction.

The great saving effected by this bench, as compared with the old system warranted the erection of more; and it was resolved to put up two other benches, containing 64 retorts each—making in all 192 retorts on the regenerative principle. Profiting by the previous winter's experience, several very important improvements were effected as follows: (1) The arch of the producer was improved and uptake ports were placed on either side, instead of one row in the center, as formerly. (2) The secondary air ports were brought in on the bed of the combustion chamber, instead of through its sides. (3) We had two combustion chamber instead of one, with a solid 9 in. wall running the full length of the oven, between them: and we also did away with the arch (the top of the shamber being open), but the placing of a protecting tile under the bottom of the center retort was necessary. (4) The piers for staying the retorts were made 6 in. instead of 9 in. broad, as formerly. (5) The introduction of a patent shoot arrangement, whereby the red-hot coke is drawn from the two center retorts directly into the producer. This shoot, when working, is at such an angle that the coke is regularly placed throughout the entire furnace. It is a fixture to the bench, and of simple construction, while all parts are maintained air-tight.

When inoperative, it folds back out of the way, and presents a very complete and satisfactory method of filling the producer. With these exceptions, the ovens are built in accordance with the description already given.

These improvements had the desired effect, producing results even better than were expected. The heats maintained in the retorts are very great. There is no hemming-in of the heat at any part; but combustion takes place nearly throughout the entire length of the setting. The two center retorts, being a little hotter than the others, are each charged with 1 ton 2 cwt. of coal, while the side ones have 1 ton each per 24 hours—all three hour charges. Each oven carbonizes altogether 8 tons 4 cwt. of coal per 24 hours; giving a yield of 9,908 cubic feet per mouthpiece per day, or 9,667 cubic feet per ton of coal. The quantity of coke used in the producer is 26 cwt. per 24 hours; or, as it is usually stated, 15 lbs. of coke per 100 lbs. of coal carbonized—the coke used containing 7½ per cent. of ash. For comparison with results in English coal—say, with 3 per cent. of ash—the fuel would be 10½ lbs. per 100 lbs. of coal carbonized. The producers were cleaned out every 36 hours; but latterly we have been doing this every 24 hours—no trouble whatever being found from clinker. We attribute this to the method of introducing the steam and to the shape of the patent producer; the steam making the clinker soft and friable, and keeping the lower portion of the producer cool, while the shape causes the coke to be held up in the form of an arch by the hot film of clinker, while the softer ash is being drawn out at the bottom through the cleaning-door by means of a rake. Thus the great rush of cold air into the oven is obviated while the furnace is being cleaned; and besides this no dust can get into the setting, as both air and dust are trapped by having to pass through the mass of red hot fuel suspended in the producer, as already described. We found that the quality of coke used for firing purposes is of some importance—splint making the best coke; although until lately we used a mixture of splint and second-class cannel, and found no difficulty with clinker.

The advantages of this system over the former methods of working are higher heats, and these maintained (not fluctuating, as formerly), and consequently a larger production of gas. This is shown by the increase last year of 272 cubic feet per ton, as compared with the results on the old plan; and this, too, with an inferior class of coals. In making a comparison, attention must be given to the quality of the coals used. This increased make is from a mixture of about one-half splints, one-fourth shales, and the remainder second and third class cannels; and this for gas of 27-candle power. The life of the retort is also prolonged. We are this year renewing the same number of retorts, after a make of 254 million cubic feet, as we did when our make was 190 millions; and this notwithstanding the fact that by having three-hour charges we get one-fourth more work out of the retorts than we did then. The saving in labor is 3.46d. per ton of coal carbonized. The retort men are much better pleased to work with the new than with the old system; and well they might be, as their labor is less, and not so trying as before. The saving in fuel is very considerable.

The cost of the first bench erected, exclusive of hydraulic mains, connections, and 40 bridge-pipes, was £1,140 5s.; being £17 16s. 4d. per retort. The cost of the next two benches (128 retorts) was £2,445 1s. 8d.; being £19 2s. 0½ d. per retort, or an increase of £41 5s. per bench. This was owing to the rise in the price of ironwork. The total cost of the three benches of 192 retorts was £3,585 6s. 8d.; being at the rate of

£18 13s. 11d. per retort. This sum included all material and workmanship, except the hydraulic mains and connections, and 120 bridge and dip pipes; and it was also exclusive of royalty. The saving in coke and workman's wages alone paid for this extension in fifteen months; and had the prices obtained formerly for coke been maintained, the actual expenditure would have been met in twelve months. The economy effected in these two items for the past year, as compared with the old plan, has been 2s. 8½d. per ton of coal carbonized. I ought to mention here that previous to the adoption of this system the whole of the retorts were in use during the winter; and we could not further extend our benches, as all the retort-house space was used up. By the introduction of the plan I have described, with its saving of 66 per cent. of retort house area, we have been enabled to avoid for at least three or four years, the expenditure of a large sum for a new retort-house; and I think we are at least entitled to put to the credit of this system 5 per cent. for the sum necessary for such an extension.

In order to ascertain the condition of temperature to which our retorts were subjected, and to what extent the heat was abstracted from the waste gases before entering the chimney, I inserted a pyrometer into the main flue near the chimney, and found the temperature to be 600° F. Testing it back to the interior of the oven through the various flues, it gradually rose till, on reaching the combustion chamber, the outer shell of the instrument, which was made of cast-iron, melted after being inserted for five minutes; the metal running along the bed of the chamber like water. We were enabled, however, to make out the temperature to be about 2,700° F., and this pretty equal over the oven, while the secondary air is heated to 1,700° F. before coming into contact with the producer gases · thus clearly showing a slow and thorough action of the regenerators.

This system is applicable to settings of from two up to eight retorts, and it has been adopted in various places in Scotland, and also in England, Ireland, and America, in all of which it is giving very high results and general satisfaction. The cost of erection varies very much in different localities, and also according to the number of retorts in each oven. In an oven of six retorts, the extra expense, as compared with the old system (including royalty), is £60. But when we consider the fact that we get one-fourth more gas per mouthpiece per 24 hours, and an increased yield per ton of coal through higher and more regular heats, it will be found that, instead of an excess, it is just the reverse, being really a saving on the old system, and this entirely independent of the large economy effected in fuel, wages, and retort house area.

Discussion.

Mr. J. West (Manchester), on the invitation of the President, opened the discussion. He said he was hardly prepared to do so; but it was a matter in which he was certainly very much interested. The paper threw some light on the subject; and the results were very good indeed. He should like to ask the writer two or three questions; and first of all as to what kind of material he used. Was it cannel, or a mixture of coal and cannel? because he was not quite *au fait* as to what was done in Scotland; and he should like to have particulars on this point. As regarded regenerative furnaces, he thought that the question was pretty well settled. He was a great advocate of the system himself; and in its early stages he carried out some very extensive experiments thereon in Manchester. They did the same as their friends had done. They worked them, but really did not know how to manipulate or to regulate them. They found that it was very necessary, if they wished to succeed with these furnaces, that they should have the very best material they could get; and some of the Scotch material, such as the Glenboig, certainly turned out better than that which they could get in England. He was glad to see that they had presented to them an inside producer. It was probable that in Scotland there were many advantages in using an outside producer; but in England they did not appreciate them very much, perhaps because their coals were of a different sort—there being less ash in them. The inside producer certainly appeared to him to be far superior to the outside one, because with the latter they must lose a quantity of heat by radiation; whereas with the former they had all the heat mostly expended inside. Several things suggested themselves to him. The first was the shoot that conveyed some of the coke into the furnaces. He did not know the object of the door below that shoot. In England they had only one place in which to drop the coke, and another below for drawing the clinker out. He saw that, in the furnace described, the producer was directly under the retorts; but in England, and especially in some furnaces with which he had experimented on a very large scale in Manchester, they came to the conclusion that it was better to have the producer brought out a little in the front. By this means they could drop the coke straight into the producer—it required no pushing back in any way; and there was a saving of fuel, with less work for the stokers. Another thing he did not understand was why there should be two exit flues. There might be an advantage in this; but they had not found it to be so in England. He had not tried the arching in the inside of the oven, as shown; but he supposed he might conclude that there was something to recommend it. The arrangement for evaporating the water was doubtless advantageous. They used pans; but when they had ash in them they did not get sufficient steam. At Nottingham they had introduced in connection with the flue a little boiler for generating steam, because they wanted more steam than they could evaporate underneath the bars. In all probability the plan shown would meet the case. The arrangement of the flues was very similar to his own. It appeared to him the cost was very low; but he did not quite understand whether or not the figures given were for the setting without the cost of materials.

Mr. T. D. Hall (Montrose) said he could not add anything to the discussion, so far as experience was concerned; but a remark made by Mr. Love had struck him. He said they had been in the habit of using splint coal, and that it answered very well. Numbers of them had not had any experience with regenerative furnaces, but they all knew what coke was; and although he found the coke of splint coal very good—better, he might say, than the coke from English coal—the addition of a little cannel rather improved than deteriorated the quality of the coke. He mentioned, for Mr. West's information, that in Scotland they had some cannel coal which produced very good coke. During the railway strike, he had occasion to introduce some Newcastle coal; and he had great difficulty in keeping their fires going with it alone. But having put in some Scotch cannel, the clinker disappeared. They had no regenerative furnaces. But they had air flues; and he could not say they had found any difference between the old furnaces and those with the flues.

Mr. J. Hepworth (Carlisle), on being invited by the President to take part in the discussion, said he had come to the meeting as a learner rather than in any other capacity. He might say, however, that he was much struck with the facts Mr. Love had given—too rapidly, he acknowledged, for his comprehension—one after another. One that had interested him most was as to the cost, to which Mr. West had referred. He (Mr. Hepworth), had had regenerative furnaces at work, and he advised everybody to have them. He did not, however, know anyone who had had such as those described; but if the results stated could be attained, it was a very important thing. He would not discuss the question of the setting they had before them with reference to the producer. If, however, Mr. Love had had any experience with settings such as those he showed, with two or three retorts in an oven, and could tell the meeting something about the results, when the brickwork did not go so low down into the ground as in the larger ones, he should be very glad to know the relative advantages that would be obtained with a setting of this sort as compared with a setting of eights. Another thing which struck him was that, where they had the main flue upon the setting, they might sometimes take advantage of it in order to obtain heat from it in some way. He had not at present a setting of this kind, except in one bench. He did not see why they could not insert, in or near to this flue, a pipe that would convey air to the outside, and be delivered at the point required over their coke furnaces. Probably Mr. Love and Mr. Hislop would have had some experience in this direction. If they had, he (Mr. Hepworth) would like very much to know from them whether there was any possibility of getting assistance of this sort in a cheap way. He assured the members that he was much pleased to be present at the meeting, and had been extremely interested in the papers read.

Mr. J. McCrae (Dundee) said he had studied Mr. Hislop's furnaces very carefully, and thought they were the correct thing, especially for small gas works. He would not, however, say they were the best for large ones. He had several on hand just now. Judging from the reports he had received from those who had had experience with them, the economy was very decided; in fact, the amount of saving seemed to him to be very great indeed. He had recommended them in several cases where ten or twelve retorts were required; and they had turned out satisfactorily.

Mr. A. Smith (Aberdeen) said it appeared to him, at the first glance, that there was not much difference between the system before them and the Siemens regenerative system. There was no doubt that it worked by the method of taking back from the setting the heat that had been used. It was really, to his mind, amusing to see the twisting and turning that had been tried in order to overcome the Siemens patent. They knew that a great deal of improvement upon the Siemens furnaces had been made by different gas engineers; but he really thought that peo-

ple should honestly accept the system, and not try to evade it. What advantage was to be gained by these over the Siemens system? He did not believe they would earn more by them than they would by the Siemens system.

Mr. McCrae thought it would be a most unfortunate thing if it were to go forth from the meeting that Mr. Hislop's process was anything like the Siemens system. There were many points of difference; and it was only to the practical student that these points appeared.

Mr. Smith said the system took the heated air that used to escape to the chimney by the old process, back to be employed again.

The President called Mr. Smith's attention to the internal producer.

Mr. Smith said he did not dispute that.

Mr. Love, in reply, said he was obliged to the members for the kind manner in which they had received his first paper. Mr. West had asked what kind of coal they used. He stated in his paper that it was made up of one-half splint, one-fourth shale, and the rest second or third class cannel. In reference to the quality of bricks, this was very important. They found great difficulty in this respect, and had to get some bricks made with about 90 per cent. of silica in them. With these they found they had no difficulty, because they would stand heats up to about 2,800° F. before melting. At these heats the bricks stood two or three years' work. He certainly found the inside producer a very great advantage. They had no loss of heat by radiation, as was the case with the other system. As to the doors, about which Mr. West had asked, they adopted those they had, so as to give accommodation for cleaning. They did not charge by the door to which Mr. West had referred. In his paper he stated that when they withdrew their clinker it formed itself into a natural arch. He thought the producer was better inside the wall of the oven, because the more they brought the producer forward the more they exposed the bench to the action of cold air. Besides, if they were to bring the producer 15 inches or 2 feet forward, they would have difficulty in getting the whole of the coke spread over the entire area of the producer.

Mr. West—Oh, much better than by that means.

Mr. Love really thought that Mr. West was wrong. He thought it was desirable that they should have the coke as equal as possible over the whole producer, otherwise there would be waste.

Mr. West—But we do get it over the whole producer.

Mr. Love understood Mr. West to say he worked 6-hour charges, while in Scotland they worked 3-hour charges; and he (Mr. Love) certainly thought a *sine qua non* process would be an improvement. With reference to the generation of steam, he might remark that they found quite sufficient steam in their pans, and they had to watch that they did not become burned. Mr. West asked about the cost of the bench. His reply was to refer him to the paper, which showed, in the second case, a cost at the rate of £18 13s. 11d. per retort, inclusive of everything. He would have been pleased, when he mentioned the subject of small works, if some of those who were engaged in them had given their experience of these furnaces, which were being built in various places in the country. With reference to flues, they considered two to be necessary to support the center of the bench. They were constructed large enough to give plenty of room for cleaning out. Altogether he thought the center wall made a much more stable job. Mr. McCrae had made some remarks about small works, which he (Mr. Love) looked upon as complimentary. At the same time he thought that those at Paisley were not small; and he might say that he had taken from their books the figures he had given. They were simply their results as to the saving of coke and other matters.

Mr. McCrae remarked that he never meant it to be inferred that Paisley had not most significant works.

Mr. Love said, with reference to the advantage to be gained by using their own as compared with other people's systems, in preparing his paper he resolved not to touch this matter, because he knew nothing about them. He simply wrote about what he knew at Paisley.

The President said he had been working with these furnaces for six years—his works being the first into which Mr. Hislop introduced them; and he made the statement openly that at first they did not know very well how to manage them. They proved almost a failure, and cost a good deal. But at the end of three years they renewed them, and put in another furnace. It was certainly an improvement; still there was a want of that which they would have desired in the way of keeping up the regularity of the heats. Last spring they introduced two ovens—one of four and the other of five retorts; and the results of their working had been most satisfactory. It took them all their time to keep down the heats—they were so excessive. In fact, if they closed up the ports, and prevented the air getting in, the result would, in some cases, be too much heat.

Mr. Smith—What would be the saving?

The President could not say exactly what it would be in small works, but he should think as much as 25 per cent.

Mining as It Was, as It Now Is, and as It Ought to Be.

By Mr. William Gillie.

It is not the object of this paper to treat of the ancient history of mining, for I presume you are already acquainted with the rude appliances that were adopted for getting the mineral from the mines and the methods adopted of ventilating and lighting them.

But the reader of such history will no doubt be surprised as he reviews the primitive appliances that were brought forth from time to time, to meet the various difficulties that were ever presenting themselves before the pioneers of this great industry of coal mining.

Each of these innovations were brought forth by a brighter and clearer mind than that of his fellows, but the conservative spirit of the miner exerted itself then the same as it does now. So that it required no small amount of persuasive force in order to introduce any new method or appliance that would be of any practical benefit to them.

When mines became dangerous, and could no longer be worked on account of fire-damp being generated, a premium was offered to the miner that could work best in the dark, after which the weak phosphorescent light of fish skins, or the small intermittent spark of the steel mill was given them to overcome the difficulty, but these all failed to accomplish the purpose, and only added misery to the dangers that they were already surrounded with. Explosion followed explosion until Sir Humphrey Davy's attention was called to the matter and his aid solicited in order to prevent the great sacrifice of human life and destruction of property. He came to the rescue and conquered, for by his invention thousands of acres of coal were worked that could not have been operated and hundreds of lives have been saved by the use of the safety lamp in gaseous mines. Various lamps have been presented to the mining world, each inventor claiming that his lamp possesses advantages that none other possesses, and that he has brought about the millennial dawn as far as the lighting of mines and the safety of the miner is concerned; but all these improvements of the safety lamp are based on the principles of the Davy. When this great philosopher wrote to a friend on this subject, he said: "I never received so much pleasure from the result of any other of my chemical labors, for I trust the cause of humanity will gain something by it." The same conservative nature that possessed our predecessors in the art of mining, seems to be hereditary, for the miners, and officials now in the profession, seem to stick tenaciously to the old forms and customs of our forefathers. Certainly we have made great improvement of late years, and especially since the introduction of the present mining law; and notwithstanding the very serious accidents that have taken place of late, I don't hesitate in saying that the miners are more intelligent and a better class of managers and officers exist at our mines than there did a few years ago. The mines are better looked after and in a better sanitary condition than they once were, yet there is room for improvement and we ought not to be slow to take advantage of it. We should not foster and cherish any pet theory or system if a better can be adopted.

There is one particular point that I will try to bring out in this paper, and I will be glad to hear the opinions of the gentlemen present on the subject, and that is the present system of ventilation as is carried on in very many of the mines in working operation in Western Pennsylvania.

The system that I refer to is the wheel system, or of coursing the air from one end of the mine to the other, in one volume and in one continuous route. By this system the noxious gases are collected in the course and are passed from room to room and from the first miner to the man in the last working place, and how often have you heard the remark and seen the wan face that was once flushed with the vigor of health, appealing for a room in the first of the air, because his system was wrecked, his constitution was weakened, and he was no longer able to fight and overcome the deadly poisonous gases that were passed on to him when he had to labor where he received the last of the air under this obnoxious system.

Another point in connection with the laying out of the mine is the driving the butt headings or entries so far without breaking off the face entries again. I think it would be much better if the mine was laid off in districts or sections, each district being separate and distinct from the succeeding district, a solid rib or pillar being left in between them, the breadth of such pillar depending on the character of the coal and the nature of the overlying strata. By this method of working, the mine will be better adapted for splitting the air current and giving to each

district or section fresh air direct from the intake. Less trap-doors would be required and the continual danger and expense of attending and maintaining such doors would be considerably reduced. For who has not heard the remark after an accident had occurred that such a door had been left open by the carelessness of some employee of the mine, or where is the manager or official who has charge of a mine that is generating fire damp whose heart has not been filled with awe, and consternation, when he thought of the possibility of a main door being left open, and the air current diverted from its course. Whereas if cross-overs or air-crossings were used wherever practical and possible, these dangers would be obviated, the expense would be lessened, and the position of the manager would be made more comfortable than it is at present in such a mine as I have described.

In addition to giving each district of the mine pure air and the other advantages that I have already named, we would get a greater quantity of air than we have at present with the same pressure and with the same amount of power expended, or if we have already sufficient air by the present system of ventilation, less power will be required when the air is split to produce that quantity. If gas is generated by this system of working and ventilation it can be confined to that district where it is being given off and handled with much more efficiency than at present, and should an accident occur (which may under the ablest management, and under the best conditions) the force would be expended in a great measure upon the district where it took place, and as a result the loss of life would not be so great, and the destruction of property considerably lessened. Instead of the dangerous gases being swept around from one place to another, increasing in volume and in force, they can by proper management be carried direct to the return airway where no naked lights ought to be. When I think of this subject I am surprised that it is not more generally adopted, for its simplicity and for its many practical advantages over the coursing system of ventilation. I do not wish you to infer that this is any new system, or that I claim to be the originator of such a method, for air-crossings were used 60 years ago, and a knowledge of splitting the air was known to a few at that time. Pillars and ribs can be extracted much safer, where the air current is divided, for a separate split can be put on to such ribs or a current can be brought after it has done its work in ventilating the rooms in a district and made to circulate through the pillars; but on no account should air after it has passed over a gob, or a place where ribs are drawn, be made to circulate through a district where the men work with naked lights and where the new workings are in operation. For it may become charged with gas and catch by the light of a miner or of a driver as he passes along, not thinking of the danger or of the result should such an accident take place.

Or what advantage is it in giving the men that are working the pillars, and drawing the ribs, safety lamps, if we allow the foul air to pass directly on to some other place where a naked light is in use? There is nothing practical about it, nor is it safe to adopt such a course as the most of you know. I am rather inclined to think that many who hold certificates of competency to-day, had they ventilated their mine plans in such a manner before the examining board would have been found wanting. If such knowedge is necessary to satisfy an examining board surely its practical application is necessary to protect life and property.

Old workings can be kept comparatively clear of gas by coursing the air through them as it pases to the up-cast, after it has done its work in the interior of the mine, or a fresh current of air can be admitted in order to prevent such places from becoming a pent-up magazine, which only needs a fall over a large area, or a reduction in the pressure of the atmosphere to force it out, and foul the main road and traveling ways.

Another thing necessary to make mining as it ought to be—safe, healthy and pleasant—is to remove the dangers as far as practicable. Coal dust is one of these dangers, at least we believe it to be, and think our knowledge is not without foundation, for this subject has produced surprise, and startled us from time to time, for now and then an explosion takes place, resulting either in loss of life or destruction to property, and can only be accounted for by the ignition of coal dust. The law by which this danger arises is that if the small particles of a combustible substance, such as coal-dust, are scattered diffusively in a volume of air, and if the proportions of air and dust are such, that the oxygen can burn up the dust, and produce a volume of flame equal to the space occupied by the dust and air then an explosion will ensue if the air contains a very small percentage of gas. In kindling a fire it will be observed that the sticks burn freely when the interspaces are such that air can freely circulate through them, so with coal dust; it is coal in a fine state of division, each particle presenting a comparatively large surface to the air and is therefore easily burnt.

Therefore let us try to remove this cause and the direful effect will cease. Mining as it ought to be needs close attention by men of keen intellect, quick judgment, and possessing a disciplined and well-trained mind. Not to be trying this plan to see how it works, and adopting that to ascertain how it pans out, but to weigh the facts in the particular case, and when once your inference has been drawn, be firm in your decision and act on it. And as we heard at our last meeting that discipline is an important element to make a successful manager, it is just as essential to make mining what it ought to be. While you are firm and decided, be kind and ready to impart that knowledge which you possess.

If a miner asks why it is necessary to fence off a place where gas has suddenly made its appearance do not deceive him by telling him there is nothing in there to do any damage, but rather tell him what is there, and the properties of such a gas, and the consequence of it becoming ignited, strive to stir a spirit of emulation among your employes to be conversant with the property of the gases and the laws that govern the ventilation of mines; by so doing a better state of things will exist, fewer accidents will take place, and then we will have the science of mining placed on an elevated platform where it ought to be.

Shoring and Underpinning Buildings.

By Alex. Black, C.E.

The essential object of shoring is to afford temporary security to dangerous buildings by arresting unsafe displacements, or to afford temporary support to buildings abutting on those which have to be taken down and rebuilt, or raised and underpinned with additional stories underneath them, or moved away to another site, or abutting on those which from their mere dangerous character require to be demolished. If there is no immediate prospect of the re-erection of buildings thus removed, the shoring should be of a more permanent character.

Photographs of Shored Buildings.—An essential preliminary proceeding to the actual work of shoring preparations in important cases is to photograph the elevations of the abutting buildings, and make written notes and sketches of details, careful measurements, and all essential particulars by which any observed peculiarities and phenomena relating to or explaining the precise character and condition of the building may be distinctly understood. All such observations should be put together in a convenient form, to be readily available for evidence in the event of litigious proceedings arising in which these facts would be important. It may also be desirable to photograph exposed division and party walls after the adjacent building has been demolished or removed, as it would be serviceable if deep excavations require to be made for deepening basements or obtaining sub-basements, cellars, or removing ballast, sand, or for any other purpose which would disturb the adjacent or subjacent soil.

Abutting Support of Adjoining Buildings.—In making excavations for foundations, basements, cellars, sub-basements, drains, or for the purpose of obtaining sand, ballast, etc., the removal or weakening of the abutting natural support of adjoining buildings renders the offending party liable for consequential damages by accident or failure of party walls thereby, and hence for neglecting to apply adequate shoring and skillful underpinning.—"Miller vs. Long," January, 1890. Judgment for $325, with costs.

Detailed Survey of Evidences of Dangerous Subsidences.—In practice it is essential to make a careful survey of the evidences of danger, as these may be manifested and can be estimated from the nature and condition of the materials of the parts of the building affected by unequal subsidences or displacements, ruptures or bulgings. The state of decay or other visible evidences of deterioration or dilapidation should be noted, especially anything of an insidious character which may ultimately tend to disastrous consequences. Faulty work, as well as materials, should be detected, and the characteristics noted. The statical condition of the masses of the ruptured walling, as they at present exist, should be considered in relation to the probable effect of the action of the shoring to be erected should displacements continue. The physical effect of the operations connected with the new erections to be built on the premises, in disturbance of the present equilibrium, should not be overlooked, such as pile driving, quarrying and blasting operations, drainage works or the escape of ground waters, the excessive sinking of more ponderous buildings erected on adjacent sites.

Practical Displacements—Vertical and Horizontal.—If there be any unequal displacement of portions of walls or of features, etc., of buildings, the comparative locations and directions of such displacements should be distinctly noted, with a statement appended of any special provision which may be needed for effecting its replacement or protection, or the arrest of the displacements if of a progressive character.

Overhanging Walls.—If the displacement be in the nature of the wall

overhanging its base, and that it is intended to be brought back to the plumb, the needling which is resorted to must be placed low enough to include above it all of the displaced portion, and then a pressure as nearly horizontal as possible is brought against it at an effective point; at the same time wedges of slate and a rather quick-setting cement should be ready for wedging up the horizontal joints of the brickwork, which have been opened by the operation of plumbing up the overhanging portion. The overhang is often irregular in different portions, and hence the treatment with needling and wedging must be adjusted to the variations needed for effecting the straightening also.

Irregular Subsidences.—When irregular subsidences have taken place in consequence of the difference of weights in the bays and pier portions of fenestrated walls, or produced by difference of heights in the bays and piers, or difference of massiveness, or difference in the bearing power of the soils at different points of the foundations, and that the wall at different parts requires to be raised to reach the normal level—for this purpose needle holes must be cut through the wall at convenient points along its solid or pier portions; but not under voids or in the bay portions of fenestrations. When there is a ground floor near the level of the ground, it is generally best to cut the needle holes through the wall in its pier portions only, and underneath the ground floor. The screw jacks are set under the ends of the needles on the inside and on the outside of the walls, and when the building is thus raised up bodily, it should be supported firmly by being made solid upon the underpinning or the built up substructure by means of close wedging with hard slate in Portland cement, so that it will maintain its raised position without subsequent subsidence. In the above it is implied that due consideration is given to the fact that the depth of the screw jacks below the ends of the needles must be obtained by excavations, etc., if this clear space does not already exist.

Periodical Observations to Detect Subsidences.—All important new or raised structures should be carefully examined from time to time to immediately detect any subsidences which may occur. The nature, directions and extents of such subsidences should be carefully obtained, the practical inferences considered and duly noted, and the necessary provision made for adopting all needful precautionary measures adapted to stop further movements. The needles, screws, etc., should not be withdrawn until all subsidences have permanently ceased. The withdrawals should, in all cases, be done gradually.

Intelligence in Observations Necessary to Efficiency.—In order that all of the foregoing important procedure may be done intelligently, and the remedies prove efficient, the amount, directions and nature of the various displacements should be particularly noticed. To acquire the intuitive power here implied necessarily involves an intelligent appreciation of a number of considerations which are seldom apparent at a glance, and must be the result of practical training in such investigations, with the aid of the theories of the composition and resolution of various predetermined active forces that are present. It must also be considered whether the displacements be in the nature of single lean over, or of various degrees of inclination at different heights, or at different points in the length of the wall, or whether it be an incurvation or a bulging of the section of the wall, and, if the latter, whether it is regular or irregular, or compounded of straight sections and curves, and where they lie horizontally, vertically, or obliquely. Also note the extent of the inequalities of displacements in the same direction when these are in the nature of unequal subsidences from the original plumb or level position. The lines and arrises of special features, such as pilasters, piers, columns, jambs, lintels, sill and string courses, plinths, and other horizontal and vertical features of a building, afford good opportunities of detecting the presence of contorting forces. Any abnormal irregularity in the curved features, or in the curved portions of features, should also be noted. All of the foregoing is assumed as essential for a single inspection; but where the occasion admits of, or necessitates testing the progress of abnormal movements, there should also be applied suitable gauges for registering the extents or inequalities of subsidences or other movements which take place in fixed intervals of times of systematically arranged observation. Thus, for showing any alterations in the width of a fissure or crack, or a lateral movement of one side over the other, paper pasted at several points is the best and simplest. When applied to external fissures the paper, and the cement with which it is fastened, should be such as not to be affected by damp. The effect of damp, and stretching or elasticity, on all papers, even when used for internal fissures, should be duly regarded, as otherwise the information afforded by the tests may be misleading. A lateral movement of one side of a fissure will produce a wrinkling of the paper. The direction of the wrinkle will not indicate which of the sides has moved; that must be determined from a consideration of other indications present which clearly point out the direction, or, as it is called in the language of graphics, the "sense" of the direction of movement.

Rod struts or laths, which bend under a slight pressure of abnormal thrusts, have been used to test the precise direction and extent of movements of central towers at the intersection of nave and transepts. These must be placed in the direction of suspected or apparent movement and carefully observed from time to time.

It is also important to observe in all tests or series of tests whether the rate of movement is unvarying in equal times, or whether there is an acceleration or a retardation in the rate of displacement. When it is one of acceleration, it requires the prompt application of very effective measures for arresting the progressive movement. It is also important to note all evidences of changes in the direction of the action with which the abnormal forces operate, and whether any new forces or resultants have been created by the incidental changes of conditions which may attend building operations.

Direction in which Forces Operate Inferred from Directions of Rupturing.—By a careful consideration of the elementary ideas of the nature of the forces of displacement, these principles can be applied to the interpretation of the fissures, cracks, ruptures, bulges, etc., which are the evidences of the action of disturbing forces, in direction and in extent, which affect any particular wall or building that we are about to investigate. Starting from the primary idea that all movements, however complex, are compounded of horizontal and vertical motion or active forces in various constant or changing ratios of combination, producing various oblique directions, we can thence form an estimate of these relative balances, or unbalanced portions, of disturbing forces, and the resistances of the tenacity of the materials, and of the construction of the building, by means of the displacements which they produce measured in these directions, then complete the graphic parallelogram of forces, and draw the diagonal as their resultant. If such measurements were constant, either in a single or compound direction, at different points of the fissure, the movements would either be horizontal, vertical, or diagonal to these two as the adjacent sides of a parallelogram. But if the measurements varied at different points of the fissure with a constantly increasing divergence—as, for instance, it showed an increase upward—it would be interpreted as a tilting action round a low fulcrum.

The Preservation of Iron and Steel Structural Work.

According to the *Railroad Journal*, the Government specifications for ironwork in the new Library Building of Congress, provide that "all the work not Bower-Barffed must be given one coat of pure red lead paint—not metallic paint of any kind, but pure red lead—before leaving the shop and before becoming rusted."

The experts of the Navy Department on the preservation and fouling of plates covered with different pigments may be interesting. A plate of iron covered with asphalt paint was immersed in sea water for eight months and six days at the United States Navy Yard, Portsmouth, N. H. At the end of that period it was found to be covered with scum and mud, and very badly rusted. A plate covered with iron paint immersed at Key West, Fla., was found to be covered with branch shell and coral, but little paint remaining, and very badly pitted and rusted. A plate with two coats of red lead, at the Norfolk Navy Yark, was found to have a few barnacles attached, but to be in fair condition, with no rust whatever on the iron after the paint was removed. It will be seen that not only did the red lead protect the iron better than the other pigments referred to, but that the plates were in far better condition as regards barnacles and fouling. The superiority of red lead being thus established, it is adopted for use on hulls of Government war ships.

On the Dutch State railroads a series of experiments extending over a period of three years were made with the above pigments on scrubbed plates, as well as those which had been pickled in acid to remove the scale. It was found that the red lead was superior in each case to the others.

If red lead is thus proved to be the best pigment for preserving iron and steel structures, what is the proper method of applying it? We have seen above that the value of red lead depends upon its forming a hard, elastic coating, having a great tenacity for the iron. This is owing to its forming certain combinations with the oil and actually setting very much the same as plaster of Paris or cement sets when mixed with water.

To successfully work with the latter substances it is necessary to put them in shape as quickly as possible after mixing with water before the setting takes place. If the chemical action of setting has partly taken place the material may be molded, but it is well known that good results

will not be obtained. Red lead, like these substances, must be applied to the work before it sets with the oil. It is on this point that failures in the use of the pigment have generally occurred, because if it be applied after the combining or setting process has taken place, the hard, elastic, clinging coating will not be formed on the iron surface.

The following is the practice of one of our largest shipbuilding establishments in applying red lead to the hulls of Government vessels: The plates are first pickled in a dilute solution of muriatic acid, then passed through rapidly revolving wire brushes, which remove all scale and dirt, leaving the iron with a bright, smooth surface; then thoroughly washed with pure water and rubbed entirely dry and immediately coated with red lead and pure raw linseed oil. The red lead is first thoroughly mixed with just enough linseed oil to form a very thick, tough paste, which will keep for several days without hardening. This paste as wanted for use is thinned down to the proper consistency for spreading with pure linseed oil, and applied at once, care being taken to leave paint pots empty at night. A gallon of paint thus prepared contains about 5 pounds of oil and 18 pounds of red lead, and will cover on first coat about 500 square feet, the second coat about 600 square feet.

In this way the red lead and oil get their initial set on the surface of the iron, and the closer the pigment is brought to the iron the more durable will it be found. Some parties prime iron with iron-oxide paint or metallic brown before applying red lead, which I believe to be a mistake, as this paint readily scales from iron, and, of course, carries the lead with it. Others coat the iron with oil before applying the red lead; this, too, prevents the adhering paint from coming in contact directly with the surface, and should be avoided, provided the iron is properly prepared, by thorough cleaning and removal of any scale and moisture, which is a matter of the greatest importance. In priming wood surfaces which are absorbent of oil, the best practice favors the putting on of a coat of pure oil, or oil thinned with turpentine, which shall penetrate the surface and form a binder for the subsequent coats. With iron the case is quite different, provided we have a paint which, from its very nature, can attach itself firmly to the surface, because it is out of the question for it to hold on to the surface of iron by any process of absorption into the pores of the metal, as linseed oil will not penetrate to any extent. Such a paint should be put directly on the surface of the clean, dry metal—as it is done in the cases of Government vessels referred to—without the intervention of a coat of oil or other substances.

The rusting of iron before the application of paint, which is sometimes recommended, should by all means be avoided, as it not only prevents the contact of the paint with the metal, but induces a chemical action which may go on with its corroding work under the applied paint.

As to the relative cost of iron-oxide paints and red lead, there is no doubt that the first cost of painting structures with iron oxide is somewhat less than with red lead. The best railroad authorities state, however, that labor in painting structural work costs twice as much as material. The true economy must, therefore, be sought in the durability of the paint as well as the preservation of the structure from rust. Actual experiments have shown that structures painted with iron paint had to be repainted the third or fourth year; those with red lead not until the sixth year. In the second painting with iron paint the old material must be entirely removed before a fresh coat can be properly applied, entailing considerable increased cost, whereas with the red lead no such expense is necessary, but, as before stated, a portion of the pigment remains on the iron, continuing to protect the surface, and is the very best base for the new coat, besides contributing materially towards it, thereby lessening the expense of each repainting.

It will, therefore, be easily seen that, although in first cost red lead may be slightly dearer than the iron paint, yet in the long run it will be greatly cheaper, besides giving assurance, for the reasons above stated, that the structure is not deteriorating from the effects of the atmosphere and paint.

Before closing this article it might be well to allude to the effects of lamp black when mixed in small quantities, say an ounce to the pound of red lead. It changes the color to a deep chocolate, a possible advantage in some cases, and also prevents the red lead from taking its initial set with linseed oil as quickly as when mixed with oil alone. Experiments recently made showed that this compound would remain mixed in paste form with linseed oil some 30 days without hardening. Thorough mixture is of the greatest importance, and shouldbe done in the dry state before adding the oil. If rapid drying is desired, japan dryer can be mixed with the oil used in thinning the paste before application with the brush.

Too much stress cannot be laid on the great importance of having the metallic surface perfectly clean and as free as possible from scale and rust before the application of the paint. Where pickling with acid is impracticable, as is frequently the case in railroad and other structural work, thorough brushing with wire brushes should be resorted to.

The Dayton (Ohio) Natural Gas Company to Its Consumers.

The Dayton (Ohio) Natural Gas Company recently presented the following interesting facts and figures for the consideration of its consumers:

As another season for the use of natural gas is rapidly approaching, the Dayton Natural Gas Company has deemed it proper to convene this meeting in order to lay before its customers and the citizens generally a full and frank statement of the facts relating to the question of the natural gas supply for the coming fall and winter.

And first in order among other things to contradict certain rumors relating to Dayton stockholders, which have appeared in the public prints, it desires to call attention to the nature and magnitude of its investment. The capital stock of the Dayton Natural Gas Company is $2,500,000, and its property is bonded for $1,000,000. Every share of the stock referred to was sold and paid for in money at the rate of 50 cents on the dollar of its par value. The bonds were sold at the rate of 90 cents on the dollar. And every dollar thus realized, aggregating the enormous sum of $2,150,000—less a small commission to Messrs. Walston N. Brown & Co., bankers of New York City, for negotiating the sales—went into the plant of the Company, leaving a large floating indebtedness, a great part of which is still unpaid.

The charge has been publicly made that certain Dayton stockholders are the holders of "promotion stock," given them without the payment of a cash consideration for assistance in promoting the enterprise. This assertion is wholly and absolutely untrue. The stock of every Dayton stockholder, like that of every other stockholder, was paid for in cash at the rate of 50 cents on the dollar. As the rights acquired by stockholders were subject to a first mortgage lien to secure these bonds—amounting to nearly $1,000,000—nearly the amount paid for the stock, it would really be correct to say that the stock cost the stockholders par.

Had the amount thus involved been placed in bank stock or loaned out on mortgage, it would have paid an annual income of from 6 to 8 per cent. interest without risk to the principal, and in many kinds of manufacturing or mercantile business it would have yielded a much larger return.

Whereas, during the whole period since the investment in natural gas stock was made—now nearly three years—it has paid to stockholders in the aggregate only 2 per cent.

It will appear as this statement progresses that, owing to a continuous impairment of the plant itself by the falling off of the gas supply, the investment, in order to be ultimately remunerative, should return to the stockholders each year, in addition to reasonable interest, a portion of his principal.

What has been done in this respect as contrasted with what ought to have been done, has been shown by the figures given.

It will also be remembered that the stockholders are subject to a double liability, and should the impairment in value of the plant continue without increase of revenue so as to destroy the mortgage security of the bondholders, the stockholders would not only lose the money they had invested, but would be subject to be called upon to pay out an additional sum equal to the par value of their stock to liquidate the bonds.

There are, perhaps still those who believe, notwithstanding all statements to the contrary, that natural gas stock has been a good investment. If so, we will say that if they want any, it will be procured for them at much less than its original cost. The best test of the value of an article is to offer it for sale in the market, and stockholders who paid 50 cents in cash for their stock have advertised it for sale at a much lower figure without bidders.

As the stock has no market value, and the only hope of giving it one or saving to the stockholders their principal invested, consisted in bringing about a favorable change in the natural gas situation by an appeal to the sense of justice and fairness of consumers and citizens, no reason exists for concealing from the public the true conditions of the Company's affairs.

It is, therefore, proper to next call attention to the present condition and future prospects of the field and plant, which the large investment referred to has purchased.

When the Gas Company first accepted a franchise from the city of Dayton, both parties believed that with the territory controlled by the Company the gas supply would last for a long period of years. It was also believed that when one well gave out another might be drilled near

by, and an initial pressure obtained equal to the original pressure of the first. Natural gas was a new product about which, as now appears, little was then known, and actual experience has demonstrated the fatality of the beliefs then existing. When the Company began business in the spring of 1888 the rock pressure of its field was 380 pounds. Since that time it has been rapidly falling off, until now, with all the draft upon the wells removed, the gauge shows a field pressure of only 238 pounds. It has also been demonstrated that when the pressure of a well falls below 200 pounds, salt water begins to come in to such an extent that, if continued, the effect is to permanently destroy the well.

Out of 86 wells which have been drilled in by the Company, 19 have become totally worthless and have been abandoned, and the flow from a large portion of the remainder has diminished to such an extent that 20 must be wholly abandoned in the near future. None of the wells produce more than two-thirds of what they did when originally drilled in. It should be further stated that by reason of the necessity of preserving a back pressure on the well only about one-half of the initial pressure can be used.

It will be seen from these facts that while on the one hand the business done has paid no adequate return on the large investment made, on the other the principal investment itself has at the same time been impaired by the unexpected falling off in pressure, and consequently in the value of the gas field itself.

For a confirmation of these facts from entirely disinterested sources, reference is made to the annual report of Prof. Edward Orton, State Geologist of Ohio, on the "Condition of the Gas Fields," and also to a similar report made by Prof. Jordan, State Inspector of Indiana, as published in the Cincinnati *Commercial Gazette* some three weeks since.

The consumer who investigated the matter for himself will find that it is now conceded on all sides that the life of natural gas is limited, and that the utmost care and economy should be practiced to preserve it as long as possible.

The present franchise requires the Company to furnish gas to the manufactories at a price equal to 75 per cent. of the cost of coal.

During the year 1890 this was done and large quantities were sold for manufacturing purposes, in many cases at only 75 per cent. of the cost of slack. As a consequence, at the close of the season of 1889 and 1890, the pressure and usefulness of the wells had been impaired to such an extent that an immediate cash expenditure of over $119,000 additional to the original investment became necessary to put the Company in shape to furnish a passable supply during the past winter.

Notwithstanding the fact that the situation had wholly changed from that at the time the franchise was granted and that the stockholders had received no return on the investment already made, this additional amount was expended, and even then, as the consumers well know, on cold days the supply was inadequate.

This year, at the close of the winter season, in order to give the wells a rest, and to save the supply for domestic consumption during the coming winter, the Company sought to be released from its obligations to supply manufactories.

Early in April, an ordinance and a petition signed by nearly every manufacturer in the city of Dayton, was presented to Council asking this relief, but nearly the entire summer has been permitted to pass without favorable action in this matter.

Meantime, as the ordinance remained in its original shape, many manufacturers have been using the gas, at the expense of the domestic consumer.

So that now, notwithstanding its best efforts to prevent it, the Company finds itself in the summer of 1891 in a worse situation than it was at the commencement of the fall season of 1890.

It has been again compelled, against its protest, to work its wells to their full capacity during the summer, and the rock pressure of its field has still further diminished, so that now it is only 238 pounds, as against 312 at the commencement of last fall's season.

It is apparent to any one that it will be impossible for the Company to furnish its consumers an adequate and satisfactory supply of natural gas during the coming winter without the immediate expenditure of a large additional sum of money, largely in excess of that made last fall, in the way of sinking new wells, laying new field lines, etc., in order to repair by increased volume, so far as practicable, the loss occasioned by the falling off in pressure.

Let the consumer ask himself the question whether he would be willing to put his hand in his pocket and make such an expenditure under the circumstances mentioned.

We do not believe that any prudent business man can be found who would do so without a future prospect for some better return than that previously received.

At any rate, the existing situation has been reported to the Eastern stockholders, who hold a majority of the stock, and they say, as they would naturally be expected to say, that as they have as yet realized practically nothing on their investment, in view of the additional expenditure of last fall and the experience of the last season, they will not expend an additional dollar on the plant, unless the price of gas is raised so as to insure them some adequate future return.

While it is true that the present price ordinance (made under a mistake of facts by both parties) has not expired, and while there may be none who, acting upon the "pound of flesh" principle, may be disposed, in the face of the justice and equity of the situation, to insist that the present price be adhered to, it is clear that the Company cannot be compelled to throw more "good money after bad" by making an additional expenditure upon a losing venture.

It is proper, therefore, that this determination not to do so should be emphatically and seasonably announced, so that should the Company be required to furnish gas at the present rate, if the supply proves insufficient, unreliable and unsatisfactory (as it certainly will, without the additional expenditure mentioned), consumers and citizens and those who represent them in official positions, will have only themselves to blame.

It has been the purpose of this statement, up to this time, to explain how the Company has been forced to the position of declining to make further investment unless the price is increased. It can be shown in the same connection that while, as has been stated, an increase is absolutely essential to enable the Company to go on and do business, on the other hand, the price can be increased without injustice to the consumer.

Under the original franchise, pursuant to which the work of piping the gas to the city was done, gas was to be furnished by mixer measurement only, according to a scale of prices fixed by the price ordinance. After the forfeiture of this franchise by council, on the evening when, through the intervention of the Board of Trade, the present one was hastily adopted, the suggestion was made by someone that a provision for meter measurement be incorporated. At this time meters were nowhere in general use. They had not been perfected as to measure with accuracy, and it was not supposed that any considerable number of consumers would desire them. The result has again proved the lack, at that time, of that definite information which experience has since supplied. Meters were soon afterward perfected, and consumers began to demand them to such an extent that up to this date the Company has been compelled to invest in meters over $47,000. This has been owing to the fact that consumers soon discovered that by using a meter at the price fixed of 10 cents per 1,000 feet they could reduce their monthly bills to less than one-half of the mixer rate. To what extent their economy has been carried is demonstrated by the fact that for the month of June the bills of the consumers amounted to only 10 cents each.

The following is a schedule showing the number of bills for the month of June, 1891, which were less than $1, arranged in classes from 10 cents up:

103	bills	from	.....	$0 10	to	$0 20
150	"	"	.....	20	"	30
163	"	"	.....	30	"	40
211	"	"	.....	40	"	50
173	"	"	.....	50	"	60
190	"	"	.....	60	"	70
307	"	"	.....	70	"	80
164	"	"	.....	80	"	90
136	"	"	.....	90	"	1 00

The total number of meter consumers for the month of June was about 2,500, so that this statement shows that three-fifths of all meter consumers for the month was less than $1, and only averaged about 57 or 58 cents. A large proportion of the bills, as will be seen, are so small as not even to pay the expense of sending a man to take the state of the meter (without doing which the Company would have no means of knowing the trifling size of the bill), to say nothing of paying the expense of the clerical labor required in bookkeeping, making out and sending statements, receiving collections, etc.

It has been demonstrated by experiment that if the price of gas as furnished by meter was increased to 25 cents per 1,000 feet, it would still cost the consumer no more than by the present mixer rate, under which laws the Company expected to act when its original franchise was accepted and its plant constructed.

This mixer rate was less than the cost of coal, and entirely satisfactory to consumers, and was the one then in force at Indianapolis, Toledo, and Lima, and was considered no more than compensatory, notwithstanding it was not then known that the rock pressure of the field would rapidly fall away, and thus impair the capital invested. In view of the present changed situation in this respect, it is clear that what would

have been compensatory then would naturally be considered grossly inadequate now. Is it not, then, perfectly just to the consumer, and less even than the Company might reasonably request, to ask that the meter rate be raised to 25 cents, so that the price may be equivalent to that which the Company expected to receive when it undertook the enterprise? If, by raising the price to such a figure, the Company can now be induced to put in the additional capital needed and continue the business, are not the people clearly gainers in getting gas at a price less than the cost of coal, and at the same price which they expected to pay in the first place, notwithstanding the fact that experience has now demonstrated the scarcity of gas and its consequently greatly increased value?

In view of all these things, the company appeals to that sense of justice and fairness by which it believes its consumers and all citizens of Dayton generally will be governed when apprised of the true facts in the case, and asks that they will recommend and request immediate action by the commissioners and council increasing the meter rate to the sum named.

It at the same time suggests and submits for consideration the proposition that it would really be no more than right to give to the Company a free field, as is the case of other commodities, leaving the price to be regulated by the law of supply and demand in competition with other fuel. The interests of the Company itself would dictate that the price be kept at the lowest compensatory figure, so as to obtain the largest possible market, and those who did not see fit to pay the price would be damaged in no respect, as they would still have wood and coal, as they had before gas was used. This course has been adopted elsewhere, and is working to the satisfaction of consumers. If it is suggested that because the pipes of the Company are laid in the streets the price of gas will be regulated by law, the reply may be made that the pipes having once been laid entail upon the public no inconvenience or expense whatever, whereas the wagons and carts of the wood and coal dealer, whose price is not regulated by law cause continual wear and tear of the streets, with corresponding expense to the taxpayers.

Immediate action is requested for two reasons:

(1) Because as shown, the additional outlay necessary to procure an adequate supply for next winter cannot be otherwise obtained.

(2) Because the Company can afford to be satisfied with 25 cents now, when, if compelled to wait for a change until the present price of ordinance expires, a higher rate would be necessary.

Many members of council hesitated to act upon the manufacturers' petition because they thought it did not go far enough, being convinced that the matter of price by meter measurement must immediately come up for consideration, and desiring to act upon all at one time.

Many of our consumers, although only partially informed as to the real facts, have voluntarily expressed themselves as in favor of an increase; and we believe that a general sentiment to this effect exists.

This meeting of consumers and citizens has been called for the purpose of stating to them the facts, as has been done, and to enable the Company to announce its determination to answer any questions which may suggest themselves.

The matter is one of pressing importance to those who desire to continue to use natural gas, as any action taken must be immediate, in order, if favorable, to give the Company time to do the necessary work before the opening of winter.

Should the price be raised, as requested, the required expenditure will be at once made, and no effort spared to make the supply adequate, and continue it as long as the pressure will transport it to Dayton in sufficient volume.

In conclusion, in order to demonstrate the entire fairness and good faith of the Company in the statement made, we will say that if this meeting desires to verify them by investigation and will appoint a committee for the purpose, the Company will convey them to the gas field at its own expense, and will afford them every facility and assistance while there.

Apparatus for Testing the Sensitiveness of Safety Lamps.

By Prof. Frank Clowes.

It is generally acknowledged that the Davy safety lamp cannot with certainty detect less than 3 per cent. of fire damp in the air of the mine. Gas indicators of much greater sensitiveness have been invented; among these the electrical apparatus of Liveing and the spirit safety lamp of Pieler take first rank. The objection to these special forms is, however, a serious one. They do not serve for illuminating purposes, and, therefore, it becomes necessary to carry an ordinary safety lamp together with the testing apparatus. Many attempts have been made to obviate this inconvenience by producing a safety lamp which will serve the double purpose of illumination and of detecting minute percentages of fire-damp. The invention of such a lamp would be of great value to the miner, in view of the fact that very low percentages of fire damp have been proved to be dangerous in the presence of coal dust.

The following apparatus has been devised to render easy the process of testing the sensitiveness of different forms of safety lamps when used for detecting fire-damp. To enable satisfactory tests to be made in the laboratory, it was necessary to insure (1) the easy and rapid production of mixtures of fire-damp and air in known proportions; (2) to insure economy of the artificially prepared methane, which represented fire-damp; and (3) to examine the flame of the lamp under conditions similar to those existing in the mine.

A wooden cubical box of about 100 litres capacity was constructed so as to be as nearly gas light as possible. It was then made absolutely gas-tight by painting it over with melted paraffin wax, which was afterward caused to penetrate more perfectly by passing an ordinary hot flatiron over the surface. This testing chamber was furnished with a small inlet tube at the top, and with a similar outlet tube below. It had a plate-glass window in front for observing the lamp in the interior, and a flanged opening below for introducing the safety lamp. This opening was closed by a water-seal consisting of a small zinc tray supported by buttons and containing about 2 in. depth of water, into which the flange dipped. A mixer was arranged, which consisted of a light, flat board, nearly equal in dimensions to the section of the chamber and suspended by an axis from the upper corner of the chamber. The mixer was moved rapidly backward and forward from the side to the top of the interior of the chamber by grasping a handle projecting through the front of the chamber.

When a mixture of air with a certain definite percentage of fire damp was required, the methane, prepared and purified by ordinary chemical methods, was introduced into the chamber in the requisite quantity by the top inlet. It displaced an equal volume of air which escaped through the lower outlet, the exit end of which was sealed by being immersed just beneath a water surface. A vigorous use of the mixer secured a uniform mixture of gas and air throughout the interior of the chamber in the course of a few seconds. The lamp was then introduced into the chamber, and placed in a position behind the glass window. The simplicity of arrangement of the water seal rendered the necessary opening of the chamber very brief, and the introduction and removal of the lamp many times in succession were not found to produce any appreciable effect upon the composition of the atmosphere inside the chamber. The appearance and dimensions of the "cap" over the flame were noted as soon as the cap underwent no further change. A lamp was left burning in the chamber for a considerable length of time, and its indications underwent no change owing to the large capacity of the chamber and the very limited amount of air required to support the combustion of the small flame always used in gas testing. The whole interior of the chamber and mixer were painted dead black, so as to render visible pale and small caps against a black ground.

The methane was introduced from an ordinary gasholder. A volume of water, equal to that of the methane to be displaced, was poured into the top of the gasholder. The gas tap of the holder was then momentarily opened so as to produce equilibrium of pressure between the methane and the atmosphere. The gas tap having then been placed in connection with the upper inlet of the chamber, the water tap was opened and the measured volume of water was allowed to flow down and drive the methane into the chamber. As soon as bubbles of air ceased to appear through the water at the outlet, the chamber was closed; the mixer was then vigorously worked for a few seconds, and the mixture of gas and air was ready for the introduction of the lamp. Before introducing the methane for a fresh mixture the atmosphere of the chamber was replaced by fresh air by removing the water tray from beneath the opening at the bottom of the chamber, and blowing in a powerful stream of air from a bellows to the top of the chamber.

The chamber was supported on legs, which were arranged so as to place it at a convenient height for observations through the window, and also for the introduction and removal of the safety lamp.

The accuracy of this method was tested by introducing the Pieler lamp into the chamber, which was charged successively with a series of mixtures containing proportions of methane varying from 0.5 per cent. to 4 per cent. The height and appearance of the cap over the flame absolutely corresponded with a series of standard tests already published and made by a different method in which fire damp was used instead of methane.

The observations were usually made in a darkened room, but the flame caps were easily seen in a lighted room, provided direct light falling on the eye or chamber was avoided.

The capacity of the chamber was 95,220 c. c.; accordingly the follow

ing volumes of methane were introduced: for ½ per cent. mixture 476 c. c., for 1 per cent. 952 c. c., for 2 per cent. 1,904 c. c., for 3 per cent. 2,856 c. c., for 4 per cent. 3,808 c. c., and for 5 per cent. 4,760 c. c. It will be seen that a series of tests, in which the above mentioned percentage mixtures are employed, involves an expenditure of only 15 liters of methane, a quantity far smaller than that required by any other method of testing as yet described.

Of many forms of safety lamp tested in the above apparatus, the one which most satisfactorily fulfilled the two purposes of efficient illumination and delicacy in gas testing was Ashworth's improved Hepplewhite-Gray lamp. This lamp is of special construction, burns benzoline from a sponge reservoir and its flame is surrounded with a glass cylinder, which is ground rough at the hinder part; this latter device prevents the numerous reflected images of the flame, and the generally diffused reflections which are seen from a smooth glass surface and which render the observation of a small pale flame cap very difficult, if not impossible.

The wick of this lamp, when at a normal height, furnishes a flame of great illuminating power. When lowered by a fine screw adjustment the flame becomes blue and non-luminous, and does not interfere therefore with the easy observation of a pale cap. The following heights of flame cap were observed, which fully bear out the unusual sensitiveness of this flame. With 0.5 per cent. of methane 7 m. m.; with 1 per cent. 10 m. m.; with 2 per cent. 14 m. m.; with 3 per cent. 20 m. m.; with 4 per cent. 25 m. m.; and with 5 per cent. 30 m. m. The cap, which with the lower proportions was somewhat ill-defined, became remarkably sharp and definite when 3 per cent. and upward of methane was present. But even the lowest percentage gave a cap easily seen by an inexperienced observer.

It appears from the above record of tests that the problem of producing a lamp which shall serve both for efficient illuminating and for delicate gas testing purposes has been solved. The solution is in some measure due to the substitution of benzoline for oil, since an oil flame cannot be altogether deprived of its yellow luminous tip without serious risk of total extinction, and this faint luminosity is sufficient to prevent pale caps from being seen.

From further experiments made in the above testing chamber with flames produced by alchol and by hydrogen it was found to be true in practice, as might be inferred from theory, that if the flame was pale and practically non-luminous, the size and definition of the flame cap was augmented by increasing either the size or the temperature of the flame. It is quite possible by attending to these conditions to obtain a flame which, although it is very sensitive for low percentages of gas, becomes unsuitable for the measurement of any proportion of gas exceeding 3 per cent. This must, for the general purposes of the miner, be looked upon as a defect, but it is not a fault of the lamp already referred to. It is of interest to note that with the Pieler spirit lamp a flame cap an inch in height was seen in air containing only 0.5 per cent. of methane.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE annual meeting of the shareholders in the Providence (R. I.) Gas Company will be held at the Company's office in the What Cheer Building at noon of September 7th.

THE genius who presides at the "complaint window" of the main office of the Chicago Gas Light and Coke Company appears to be quite a philosopher--in fact, men occupying similar positions with any corporation require a lasting fund of calmness in order that they may have their pay checks audited twice in succession—as the following from the Chicago *Tribune* will show: "I have nothing to say about the job I hold. I took it knowing what it was, and am satisfied; but there are very few men who could hold it. I do not mean to have you infer from that remark that I am smarter than any one else, but it requires a peculiar temperament. The complaints made at this window have greater scope and variety than those offered at any other complaint window in the city. You see, in the first place, everybody has an idea that he or she is being swindled by the Company, and when a complaint is entered here the complainant appears to be under the delusion that I am to blame. Take the case of that old lady who was here just as you came up. She had failed to get her bill for the month. Well, that often happens. She said she had been occupying her place three years, and had never missed a payment. I looked her up on the books and found that she had told the truth. I referred her to the proper authority in the case, whereupon the gentleman told her to come to me and get a duplicate bill and that it would be all right. She promptly went into a series of semi-hysterics, and evidently not knowing the meaning of the word duplicate, came rushing back to me shrieking: 'And it's a duplicity bill ye want to give me now. You are a thief and I always knew it. I never got me own bill for the month, and the man over there says ye are to give me the duplicity bill and that he is going to discount it. Oh, my! Oh, my! The shame of it be upon both of ye for trifln' with a poor old widdy, as I am. I'll never pay any duplicity bill; and if that wretch over there undertakes to discount it I'll slap his face, as old as I am.' I had to ask a customer who was near the window at the time to explain to the excited old lady that the Company was violating one of its rules in order to accommodate her, and that she was not going to be swindled. Well, that is only one instance in a hundred which I have every day. It is so seldom that a complaint is made here in a polite manner that we are struck with the oddity of it. Clerks, like other people, are human, and it is no wonder they sometimes lose their patience."

THE new works of the Streator (Ills.) Gas and Light Company are well under way. It is estimated that cost of the same will be not less than $30,000, and Superintendent Lukins will supervise the construction. The site chosen is close to the Company's electric lighting station.

THE electric lighting station of the Louisville (Ky.) Gas Company is well along toward completion, and Mr. Barret is quoted as having said that everything will be in working order by October 1st. This station will be one of the best in the country in respect to equipment and supply practice.

WE understand that Mr. William M. Butler, of counsel for the proposed Consumers Gas Company, of New Bedford, Mass., has appealed to the State Board of Gas and Electric Light Commissioners from the decision of the local Board of Aldermen respecting the Company's petition. As before stated in the JOURNAL, the Consumers Gas Company projectors applied to the Aldermen for permission to dig up the streets of the city for the purpose of laying pipes, and the City Fathers, after some consideration of the matter, voted to dismiss the petition and referred the petitioners to the Board of Public Works. Mr. Butler appeals from this decision and bases his remonstance on the ground that the statute intended to cover this class of cases specifically places the matter under the jurisdiction of the Aldermen. He accordingly goes before the State Commission for relief.

IN the meantime it is well to bear in mind the fact that the Consumers Gas Company has its foundation, not so much in the desire of its promoters to furnish New Bedford with cheap gas as in the willingness to injure the old gas company because of the latter's pertinacity in the matter of securing complete control of the electric lighting supply of the city.

MR. W. W. PRICHARD, the General Manager of the Ironton (Ohio) Gas Company, writing under date of August 22d, says: "Business is good notwithstanding the Electric Light Company has worked hard to cut in on us. The latter's managers seem to be changed frequently, and one of the Company's head men puts in most of his time here, but still our sales keep up. The gas stove trade is good."

WE are indebted to a correspondent at Dubuque, Iowa, for the following: "The City Council at its last session received the following proposal for lighting the city or a part of it with gas: The Key City Gas Company proposes to light any number of gas lamps, in excess of 150, at $22.50 each per annum, lighting to be done on the plan now followed. To light from midnight to daylight, on plan now followed, any number of lamps, in excess of 300, $12.50 each per annum, these figures to include lighting, cleaning and keeping in repair. The gas company makes claim that the 100 arc lamps now used cost $7,500 per year and displace 217 gas lamps. To replace the gas lamps would cost, at the prices named in this proposal, $4,882.50 or $2,617.50 less than the cost of the arc lights; and for the amount that is now paid for electric lights, the city may use 341 gas lamps, or 124 more gas lamps than were displaced. This would be an increase over the number of gas lamps formerly used in this district of over 55 per cent. The installation of the arc lights has not lessened the expense for gasoline lamps. The city about a year before installing the arc lights contracted for 300 gasoline lamps, and is now paying for 310. If, as proposed, the city adds 50 to the number of arc lights now in use, then the expense of lighting this district with arc lights will be $11,250 or more than double the $5,940 which the 270 gas lamps formerly used will cost. If the city wishes to expend so much money for lighting this district, then for this sum there may be used more than double the number of gas lamps formerly used, which would provide lighting for all the alleys and bye-ways, the lighting of which was never before thought of. In all the metropolitan cities gas is largely used in street lighting, and will be for many years to come. For

instance, last May New York contracted for 28,071 gas lamps; St Paul last June contracted for a large number of lamps, and Chicago, on June 13th, contracted for several thousand lamps, the contract to run for 5 years. In estimating the benefits derived from the different systems of lighting, no inequitable comparison should be made of the value of the $7,500 worth of electric lights now used as against $4,882.50 worth of gas lamps displaced; but as against the 100 arcs allowances should properly be made for 341 gas lamps, or 124 more than were formerly used in the district."

THAT prince of estimators and cleverest of gentlemen, Mr. Fred. Mayer, of the house of Bartlett, Hayward & Co., looked very warm—and was very warm—one Saturday afternoon, hurrying off to his train. Heat and humidity had New York in her grasp, hence Mayer's indication of an excess of temperature. He managed, however, to find time to say the past summer has been the busiest one in the history of Bartlett, Hayward & Co., respecting construction on gas works account.

"THE authorities of Kansas City, Kan., seem to be possessed with the idea that it would be a good thing were that 'great and gloriously thriving city' prepared to take up the business of manufacturing and distributing electric currents on public account. The city has for some time been blessed with an electric lighting concern, known as the Consolidated Electric Light and Power Company, that has had a contract for the public lighting for quite a while. The city, however, has not been paying as promptly for this service as the owners of the Company wish, the amount in default being something like $14,000 on or about June 1st. If we mistake not, the Company has not been a very striking example of financial success, and if we further mistake not, some of those closely identified with the reigning local fathers are largely interested in the Company's fortunes. Between them all they cooked up a 'healthy agitation' looking forward to the unloading on the city of their plant and franchises, and in due time the Mayor and Councilmen interviewed the Company's proprietors as to whether the latter would sell their possessions. Knowing the 'value' of these, they modestly cleared their throats—the a'hemming process was the one chosen—and, finding voice at last, replied in dulcet tones that 'perhaps they would.' Next in order was naming the selling price, which the Company, through Manager Friedman, put at $375,000. O, my parents! Before the offer had been read twice by any of the City Fathers, the city promptly bid $340,000—and then the taxpayers took a hand in. According to the best informed of the residen's, the plant was not worth a cent in excess of $50,000, and you may well imagine the howl that went up from those on the 'outside.' In fact, I am told that some of the remonstrants were in favor of a lynching bee to prevent the Fathers from carrying out the proposed trade. The protests were so vigorous and many that a partial halt in the negotiations was ordered, but the Company finally relieved the authorities from their plight by announcing, again through Manager Friedman, that, as the city would not pay $375,000 for the 'plant,' the trade was off. His communication announcing this 'determination on the part of the Company' was couched in terms the unvarnished material of which would do credit to the 'shine' of any society reporter. For instance—remember the difference between the real value of what he had for sale and the price that he 'refused' for it—I submit one paragraph of his declination: 'The Company recognizes the fact that a large majority of the people of the city are in favor of the ownership and control by the city of its street lighting system, and it believes that its proposition of $375,000 is no more than the fair value of its plant, measured by its earning capacity and net income. If the city shall desire further to negotiate, the Company will at all times stand by its original offer, and will submit the question of the value of its works to any disinterested board of experts, agreeing to be bound by such decision.' Manager Friedman is beyond doubt a man of nerve, but such men are required in a gap that was actually bristling with taxpayers and residents, enraged at the idea that they were about to be plundered in due form of law.—SANTA FE."

"OBSERVER" says there is a possibility that Mr. Geo. F. Macmunn, who succeeded Mr. Todd in the management of the Natick (Mass.) works, will not remain much longer in charge there.

GENERAL MEYER does not seem to have made progress in his financial investigation of the affairs of the Cleveland Gas Companies. The City Council that instituted the investigation begun badly in that it appeared to be firmly convinced that everybody connected with the Companies was, to say the least, positively dishonest. Such men as Messrs. Morley, Warmington, Beardsley and Hyde are not to be bulldozed in that way. In fact, we imagine their records will bear a stronger light as would those of "General" Meyer.

COL. BENSON of the Nassau (Brooklyn, N. Y.) Gas Light Company, has applied to the building department for permits for the construction of buildings, as follows: West side of Kent avenue, 464 feet north of Cross street, 1 story brick structure, 42 feet by 190 feet; estimated cost $25,000. Kent avenue, west side, 405 feet north of Cross street one story and basement brick building, 47 feet by 63 feet; estimated cost $20,000; also adjoining last-named, two 1 story brick retort houses, 38 feet by 96 feet, estimated cost, $30,000. These buildings are intended to house the auxiliary water gas plant, of the Wilkinson type, that has been arranged for by the Company. We understand that Messrs. Bartlett, Hayward & Co. will put in the apparatus complete.

THE active man at present in the management of the Austin (Texas) Gas Light and Coal Company is Mr. W. E. Holmes.

AN advertisement in the Omaha *Bee*, signed "W, 3," offers for sale an electric light plant "in a county seat town within 80 miles of Omaha." The plant consists of two dynamos, rated to maintain 1,350 incandescent lamps of 16-candle power each, one 60-horse power Westinghouse engine and two 60-horse power boilers. The advertiser says he will dispose of the outfit "for one-third cost price; half cash; balance, unincumbered real estate."

THE Altoona (Pa.) *Times* says that the Watch and Lamp Committee of Council has practically abandoned all idea of introducing electricity generally throughout the city. Continuing, the same authority remarks: "A plan is being formed, however, that will include both gas and electric lights and bids will be asked for on that basis. By this system it is claimed the principal streets will be lighted by electricity while the minor thoroughfares will have gas. The main reason assigned for not pushing for a general electric light system is because it is more than likely the matter of its great cost. As a member of the Committee said, 'The great drawback is the cost. While a single electric light will only displace two gas lamps—as these have been distributed hitherto in Altoona—the electric lamp costs very much more than the two gas lamps.' The Committee report the following prices paid for public electric lighting at different points in Pennsylvania: Ashland, 23 arcs, at $125 each per annum. Wilkes Barre, 48 arcs, at $144.54; Lancaster, 139, at $124.10; Reading, 156, at $146.75; Harrisburg, 270, at $90; Philadelphia, 800, at $105. All these lamps burn each night and all night."

THE Malden and Melrose (Mass.) Gas Company is putting in a new 12-inch leading main for the better supply of Melrose. It replaces a 6-inch main. This shows what can be accomplished by concessions in gas rates—the Company having made a substantial concession in this respect last Spring.

THE Belfast (Maine) Illuminating Company has made proposals looking to a consolidation of its business with that of the Belfast Gas Company. It is likely that the negotiations will be successful.

ADVICES from Dallas City, Texas, are to the following effect: "The Committee on Lights, to whom was referred by the City Council the bills submitted for the construction of an electric lighting plant to be operated on municipal account, have considered the proposition, and report that the cost of installation and subsequent operation of the plant would be altogether too great; and that it would be better to continue to have the public lighting performed by private corporations. It was, therefore, resolved to recommend the rejection of all bids received. The question of operating a plant in connection with the power at the pumping station was considered impracticable until such time as the machinery there will be increased, 'or in more reliable running order.' The bids referred to the Committee were as follows: The Cornell Electrical Engineering Company, of New York, $92,500, not including building, boilers or machinery; F. O. Brown, two bids, one of $90,000 and the other, of $115,000. Under the latter of these he agreed to put the wires underground on Main and Commerce streets from the river to Akard street. On the completion of the plant he would run it for 5 years, furnishing the city light at the rate of 40 cents per lamp per night. A bid from the Eastern Electric Company, of New York, not being accompanied by the certified check required by the conditions was not considered."

THE use of the detersive effect of a stream of water has been very general in the hydraulic mining districts, where hills of gold bearing earth have been washed away by very powerful streams connected from

elevated sources of water supply in the mountains, and the gold being afterwards found in more concentrated form deposited in the valley at points where the current was rapid enough to bear away the earth; but the deposits of earth on the arable lands in the valley below have been so destructive to grazing land that stringent legislation has been necessary to prevent the continuance of this practice in some sections of the country, notably in California. Recently, however, there has been an application of the same practice, but for a reversed purpose, and that is on a line of railway in Michigan, where an available supply of water was used to wash down gravel deposits among trestles on timber viaducts along the line of the road, and in that manner to deposit gravel in such a way as to fill up a solid embankment to the line of the track. By guiding these movable sluiceways and also altering their slope or the supply of the water, the direction and velocity were controlled so as to accomplish the result in a very cheap manner, the expense of filling being said to be less than three cents per cubic yard. At Scranton, Pa., there are numerous piles of anthracite culm in the vicinity of the coal breakers over the pit's mouth, at the mines, and recently this material has been put to considerable use under boilers, as the mines proprietors gladly accept offers of 10 cents per ton for it. An electric light and power station has been built near one of these culm piles, and the coal taken from the pile to the fire room by means of a stream of water and a sluiceway. Just outside of the delivery in the fire room the bottom of the sluiceway is perforated so that the water can pass away, and the fuel is delivered at the fire room in a reasonably dry condition, as the water passes away from it readily. When the low cost of the fuel and slight expense of its transportation are considered, it is held that the amount of moisture in the fuel is merely an item of lesser expense in comparison with other means of delivery.

Mr. C. H. Curtiss, Secretary of the Tarrytown and Irvington (N.Y.) Union Gas Light Company, under date of August 22d, caused the publication of the following notice: "All purchases for account of this Company will be made by written order, signed by the President or Secretary, and such orders should be attached to the bill to insure payment. No goods will be paid for unless ordered by the President or Secretary, as above stated."

Some misunderstanding has cropped out respecting the plans and specifications for the buildings to contain the electrical machinery of the Wheeling municipal lighting station. At a meeting of the Commission the specifications for the buildings and the plans for the same were the matters under consideration. When the plans were examined it was found that the dimensions of the boiler house were wrong, the building shown being but 49 ft. 9 in. long, from east to west, which would afford room for only 4 boilers, whereas the battery is to consist of six boilers, with a 12-foot driveway between the east boiler and the west wall of the engine house. The architect, Mr. E. B. Franzheim, was instructed to so change the plans as to provide for a boiler house extending west as far as the east wall of the gas works stable, which will add about 19 feet to the length of the building, and give room for the two additional boilers and the stack. The location of the engine foundations was not shown upon the ground plan, nor was the foundation for the shafting, etc., indicated. After a discussion it was resolved to place the whole matter in the hands of the executive committee, with instructions to make all additions, rectify errors, etc. The house shown in the plans is a plain structure, 16 feet high to the top of the walls, and 28 feet to the comb of the roof. It is well adapted to the purpose for which it is intended.

The following rules have been adopted by the New Orleans Gas Light Company respecting the use of meters by consumers whose use of gas is of a limited nature: "As experience has proved that gas meters deteriorate rapidly when not in use, the Company has established the following rules for the protection of its property in the hands of occasional consumers, who do not rely upon gas for illumination but make a convenience of their gas connection when other lights fail. *Rule No. I.*—The supply of gas will be discontinued and the meter removed from all premises where no consumption of gas has been recorded for one month. The Company furnishes at its own expense meters adequate to the supply of gas required in the premises. When a reduced consumption is recorded, and warrants the change to a meter equal to the wants of a consumer, the meter will be changed; but for the satisfaction of the consumer who desires to retain the larger meter, the Company will allow the meter to remain under the following conditions, which are made in order to secure itself against loss for the use of the service as well as the meter. *Rule No. II.*—A monthly rent, varying with the size of the meter retained, will be charged and added to the gas bill, when the consumption does not reach twice the amount of the rate here stipulated: 5-light meter, $1 per month; 10-light meter, $1.50 per month; 20-light meter, $2 per month; 30 light meter, $3 per month; 45-light meter, $4 per month; 60-light meter, $5 per month; 80-light meter, $6 per month; 100-light meter, $7 per month; 150-light meter, $8 per month; 250-light meter, $10 per month."

It is reported that the Delaware, Lackawanna & Western Railroad will light all its passenger cars with gas made under the Pintsch system—the result of an experiment with the gas on some of the Company's coaches running over the Morris and Essex branch.

About a fortnight ago a special town meeting was held at Peabody, Mass., for the purpose of voting on the proposition to establish a municipal electric lighting plant in accordance with the provisions of the general act of the State. The vote stood, 459 in favor to 32 opposed.

There is much complaint at Columbia, S. C., over the poor quality of the incandescent electric lighting service in the city. The Gas Company is enjoying the situation.

The Consolidated Gas Company of this city has expended large sums of money this season in overhauling and improving its main system. Some of the lines were in very bad shape.

A Large Chimney.

A contemporary notes that a chimney of important proportions has been erected in Germany. It is intended to carry away the deleterious gases from a smelting works, and to deliver them at a sufficient height above ground-level to avoid all risk of nuisance. An elevation of 324 feet above the highest ground in the neighborhood was considered to be necessary. The chimney is situated near the summit of a hill, and at a distance of about three-quarters of a mile from the works; and the base is nearly 200 feet above their level. The ground at the site consists of compact gneiss rock, and was simply dressed by hand and covered with a layer of concrete about 4 inches thick. On this a foundation pillar 40 feet square was erected, and a rectangular base-block 33 feet square by 30 feet high. The chimney proper was built on the base; commencing with a circular section a little smaller than the base, and carried up with an outside batter of 1 in 50, to a diameter of 10 feet on the top. The height of the circular portion is about 430 feet; giving a total height of 460 feet, or 660 feet above the works, from which a flue was carried along the surface of the ground. The thickness of the wall is nearly 5 feet at the base; gradually diminishing to 9½ inches at the top. The chimney is divided into 26 annular sections, each diminished in thickness by about 2 inches compared with the one below it. The first 12 sections are of equal height—about 10 feet; then follow 3 or 4 longer ones, ranging from 60 to 25 feet; and the remainder 13 feet each. The structure includes 5,400 tons of building materials, and an iron cap weighing upwards of 15 tons. The inside diameter is 18 feet at the base, diminishing to 8½ feet at the top. The data used in determining the thickness of the wall were a wind pressure of about 200 lbs. per square inch, a co-efficient of stability of 4.3, and the weight of the finished brickwork as 125 lbs. per square foot. This would give a pressure, under the maximum wind effect, of 240 lbs. per square foot on the stack and base, 126 lbs. on the foundation, and 72 lbs. on the solid rock below. With the load at rest, the maximum pressures would be respectively 160,85, and 54 lbs. per square foot.

In order to keep the maximum loading within the limit of 240 lbs., it was necessary to make the lower third of the stack thicker than was required on the consideration of stability alone. Iron rings of 2¾ in. by ½ in. section, put together in four segments, were built in at intervals, the rule being to place them at a distance apart equal to two thirds of the diameter at the place where each one was fixed. This has the effect of gradually bringing them closer together from the bottom upwards. The cap is of cast iron of **V** section, enclosing, but quite independent of the top of the stack. It is built in 16 segments, having projecting lugs on the butt edges, which support cast iron cappings covering the joints. The whole is thus free to expand or contract without reference to the brickwork. Climbing irons are provided both inside and outside; the former being in double series opposite each other, and the latter supplemented by safety staples about 22 inches apart. Two lightning conductors, of copper 0.4 inch diameter, are connected to the cap, and carried down the outside; one being also attached to each iron ring. They terminate in copper earth plates 7 feet square—one buried in damp ground at a distance of 100 yards from the chimney, and the other in a cistern through which water is continually flowing. No external scaffolding was used; the interior climbing irons being utilized for supporting the lift pulleys during the building.

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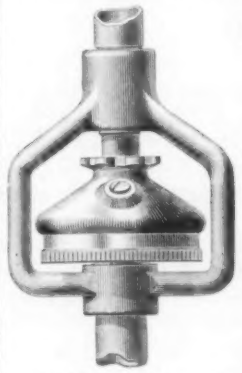

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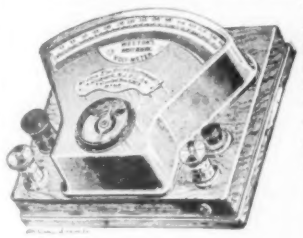

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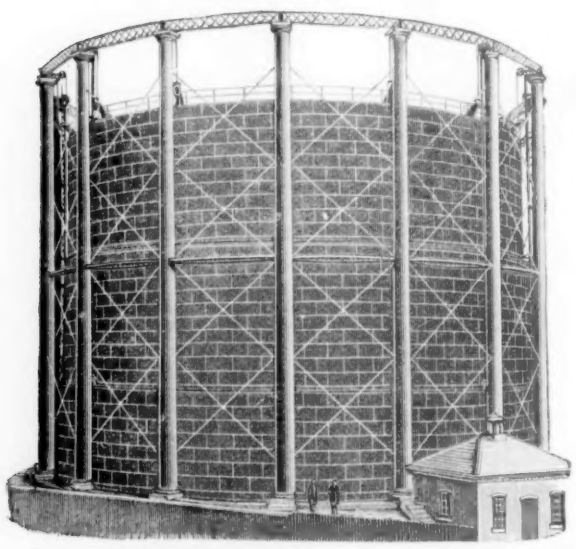

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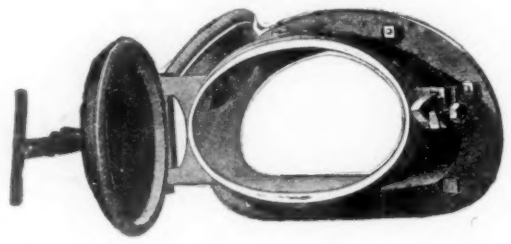

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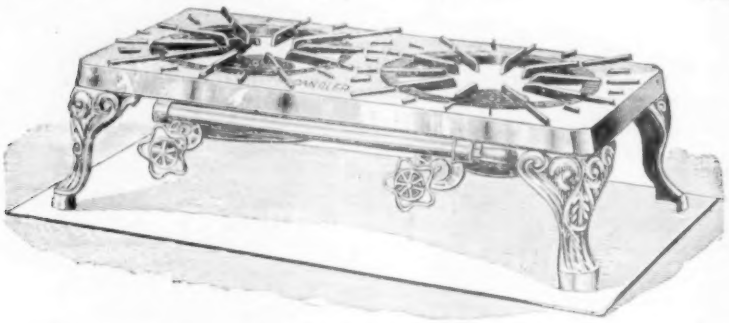

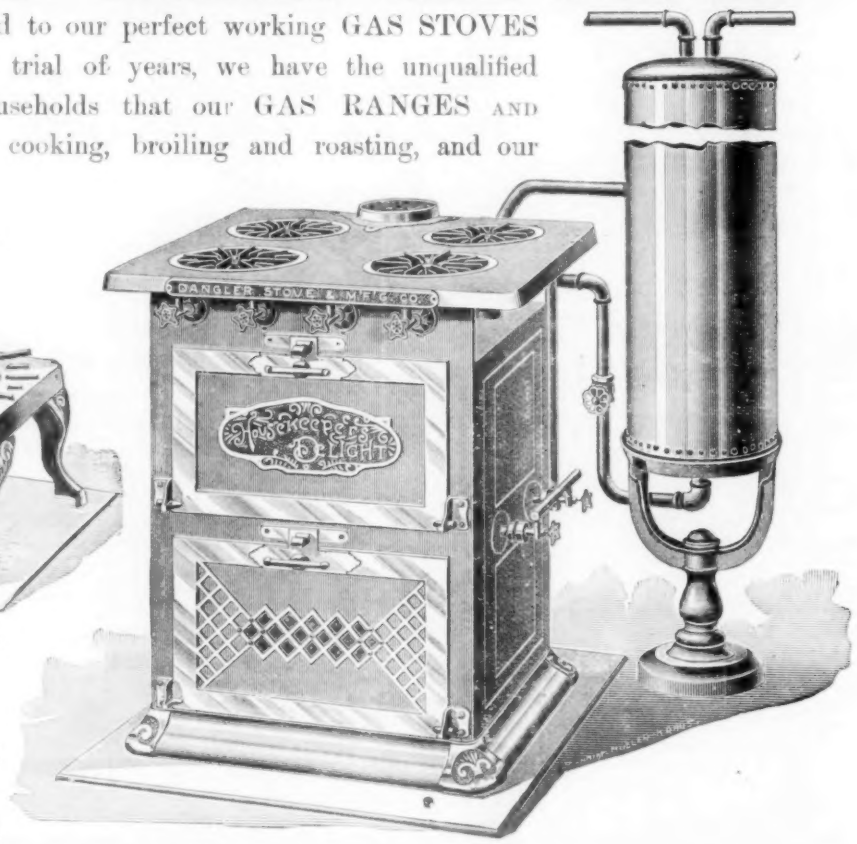

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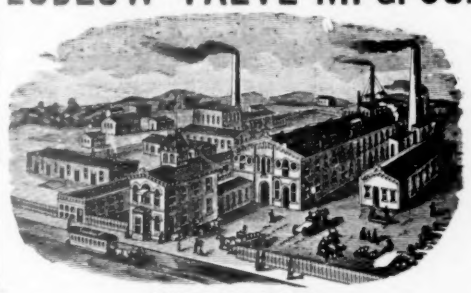

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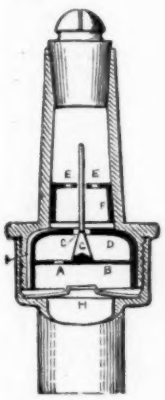

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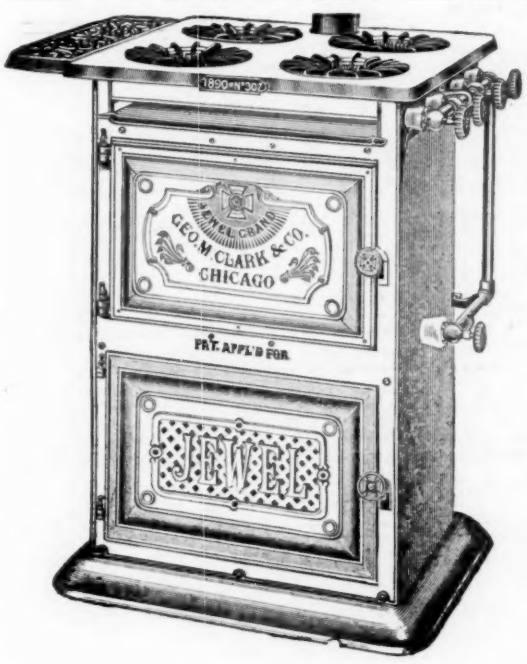

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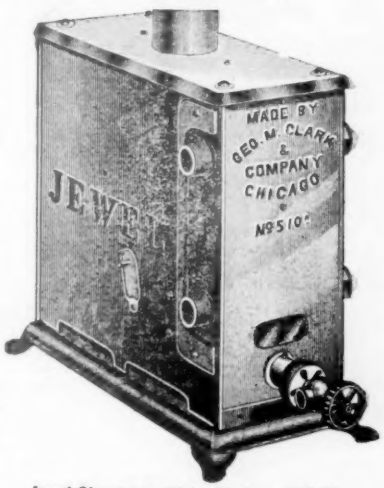

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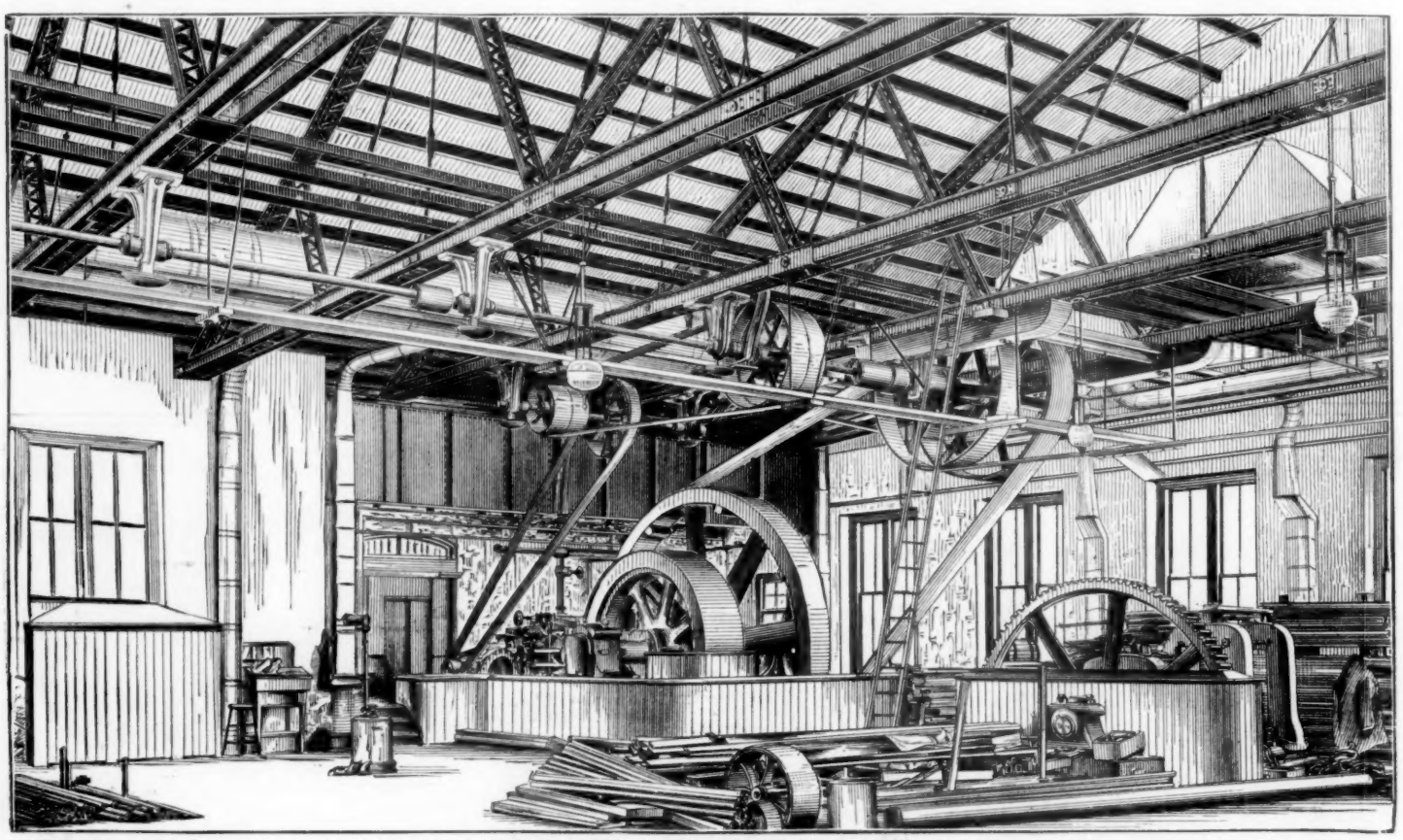

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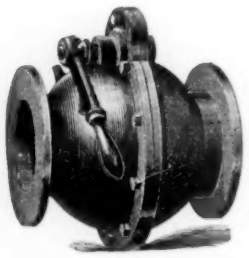

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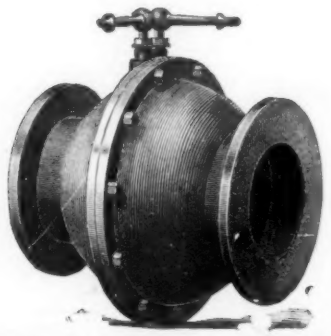

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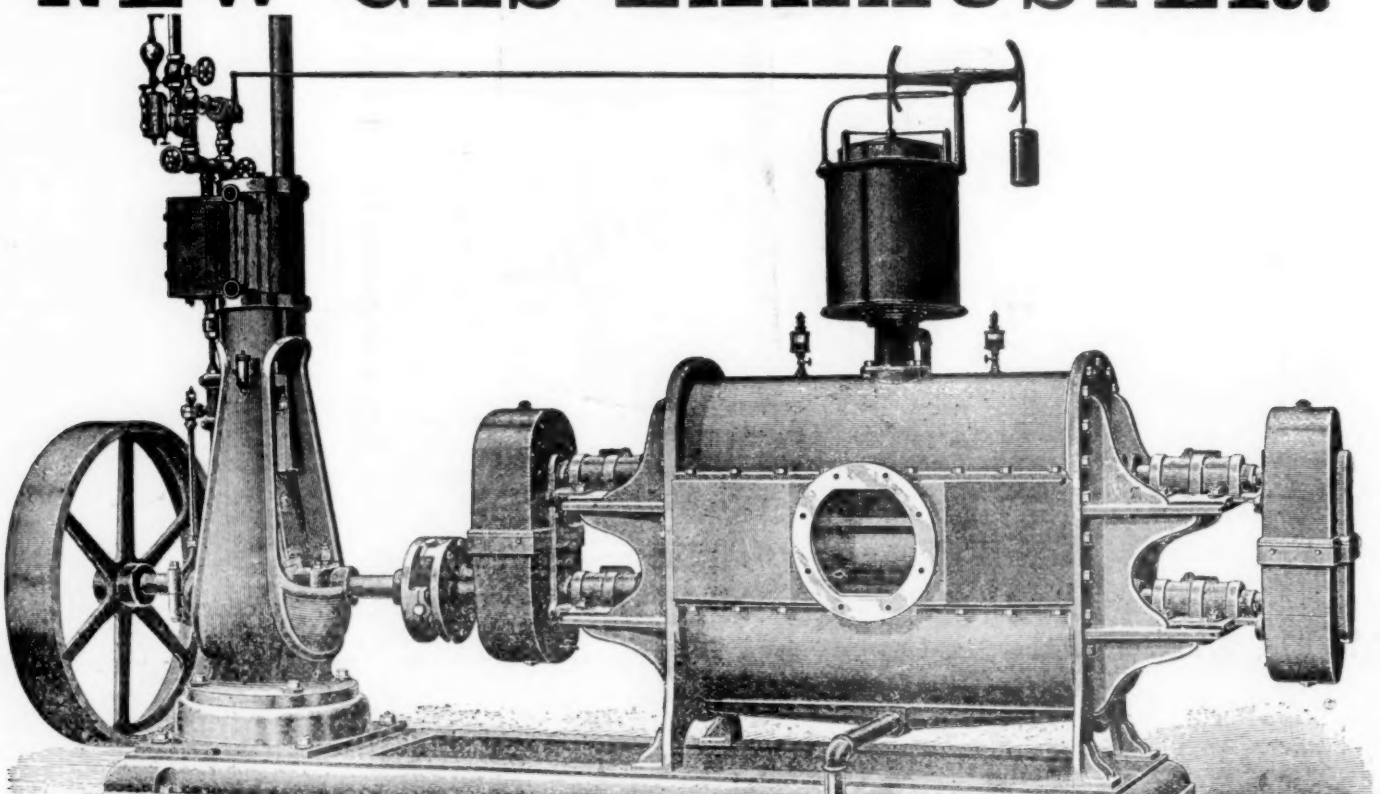

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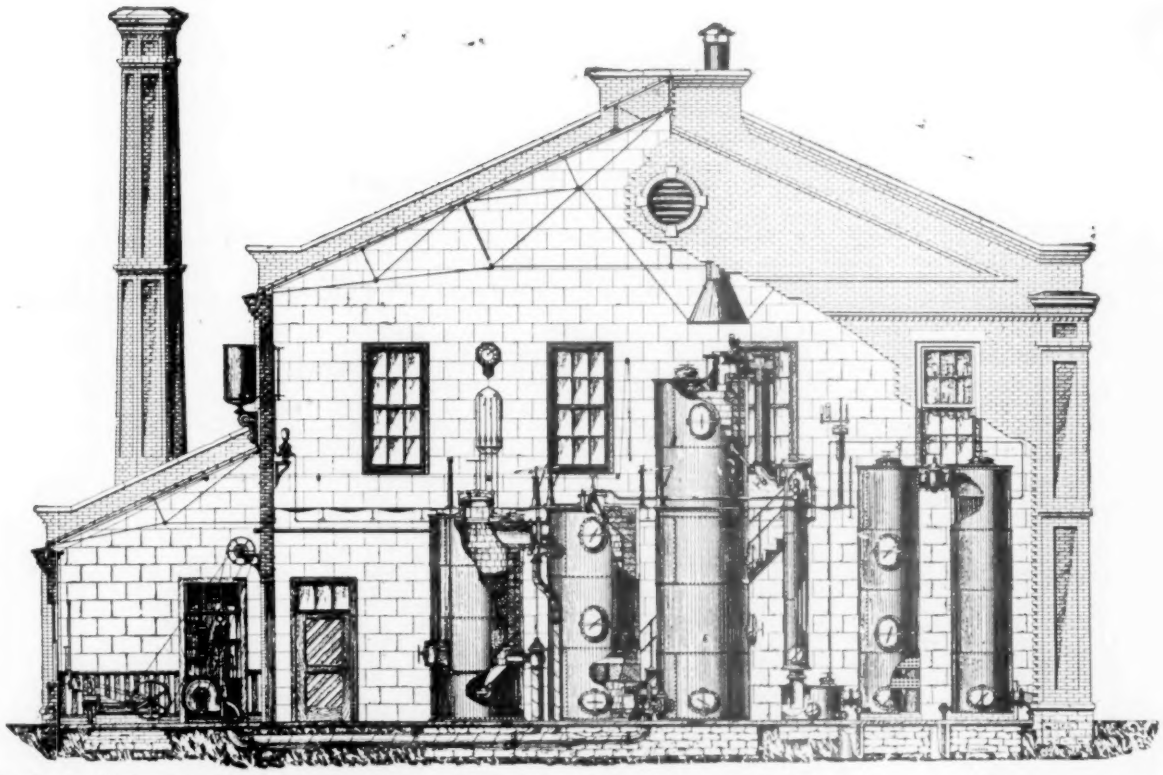

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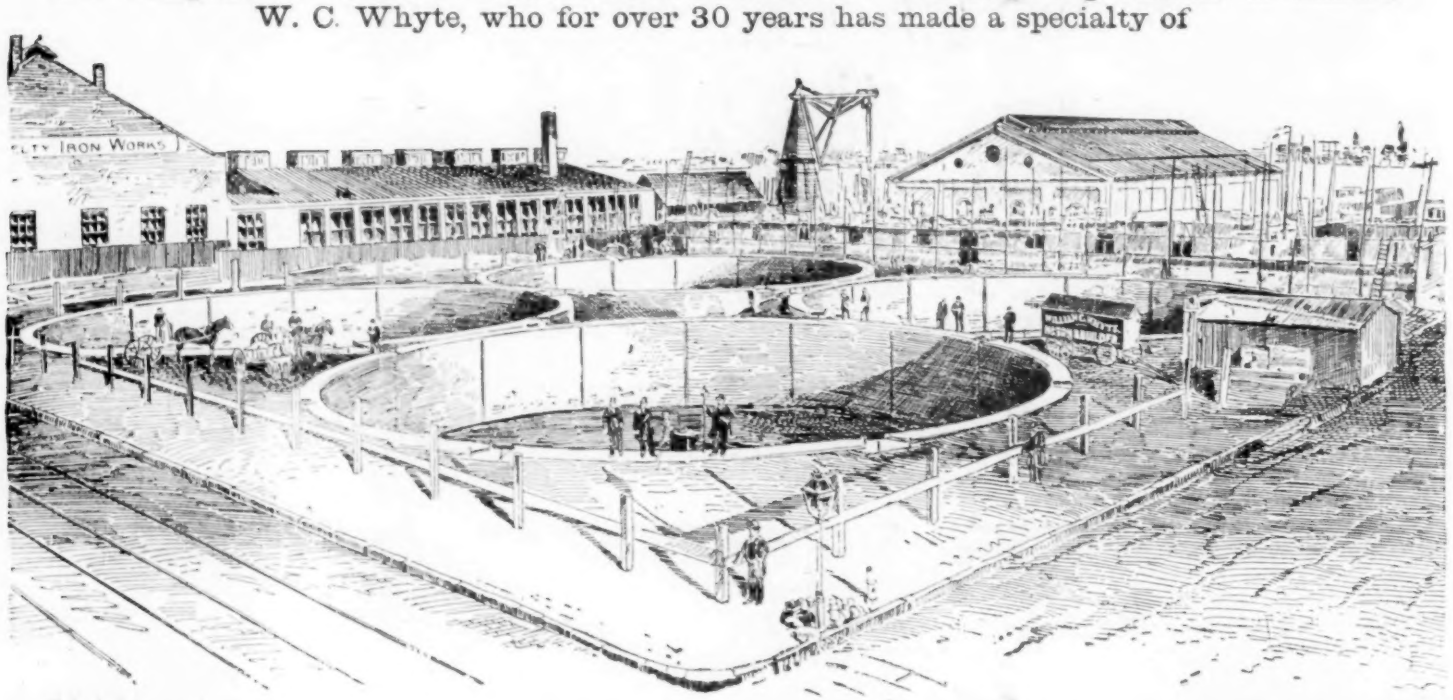

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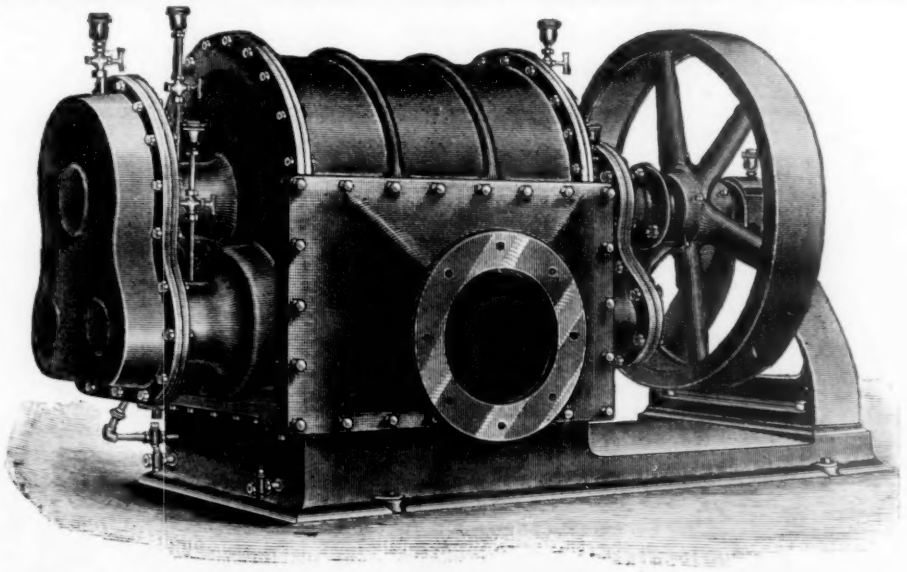

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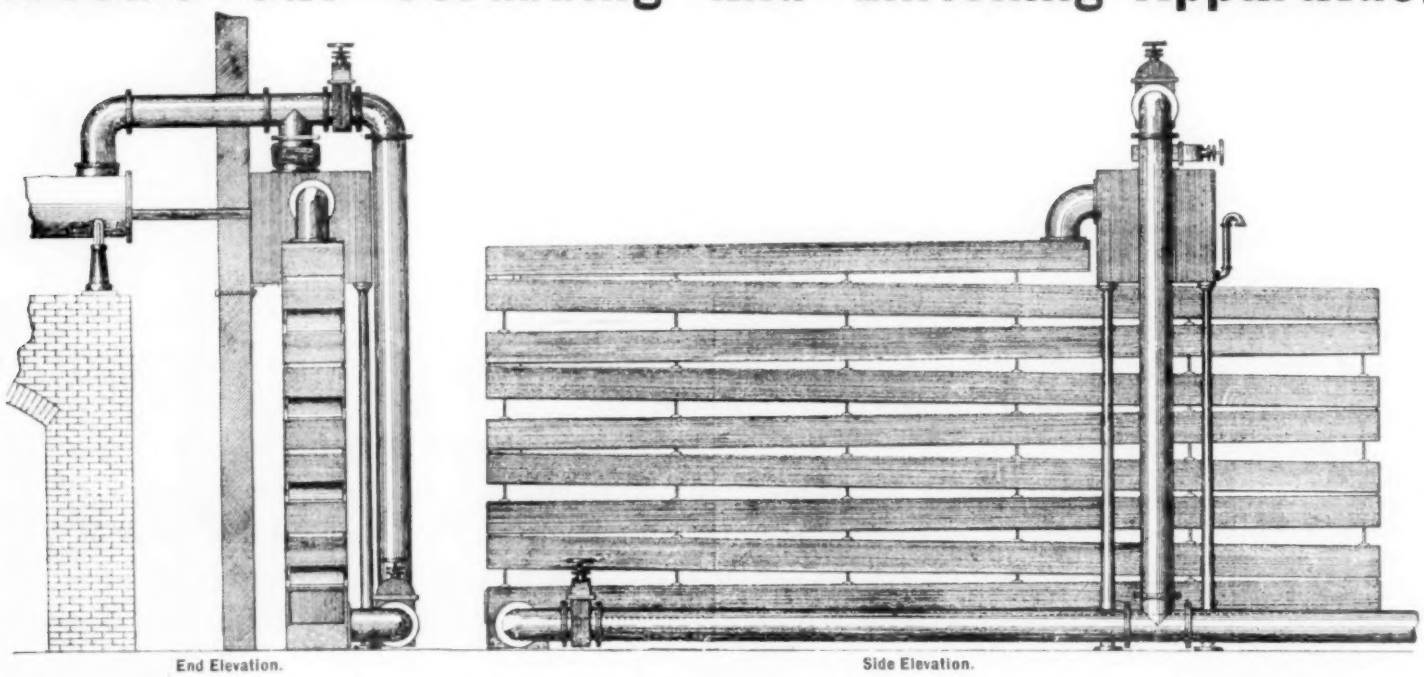

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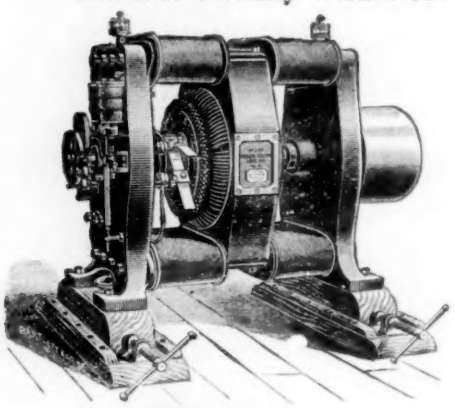

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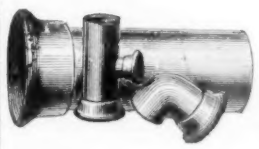

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New York, West Shore & Buffalo Railroad Co	6	340
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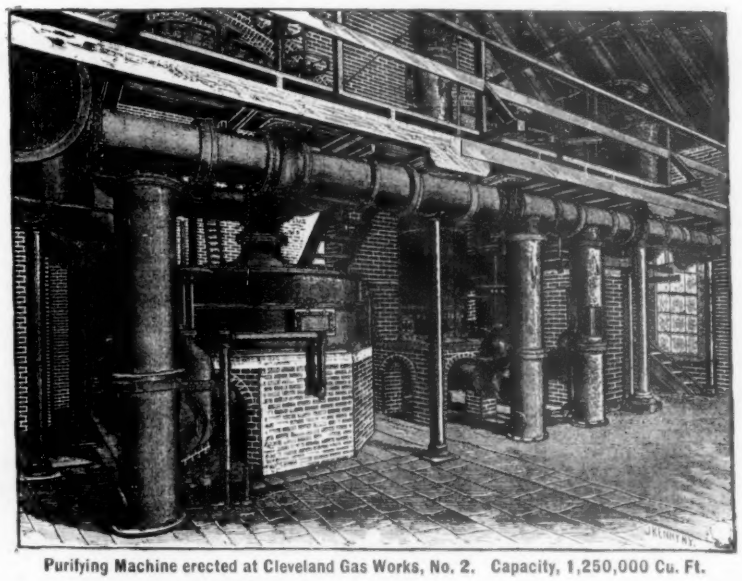

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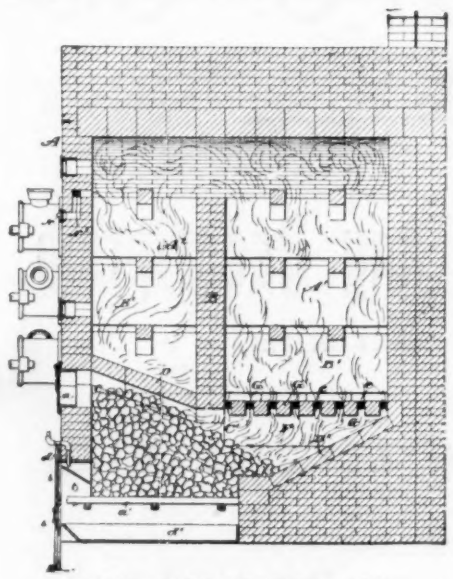

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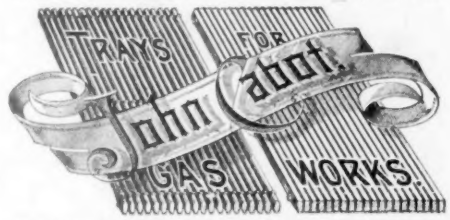

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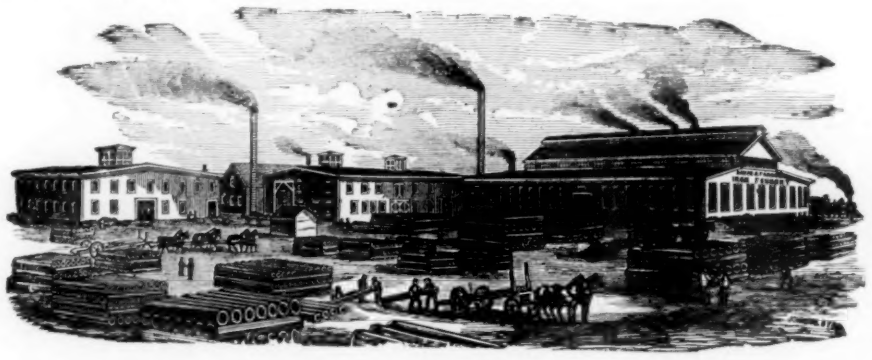

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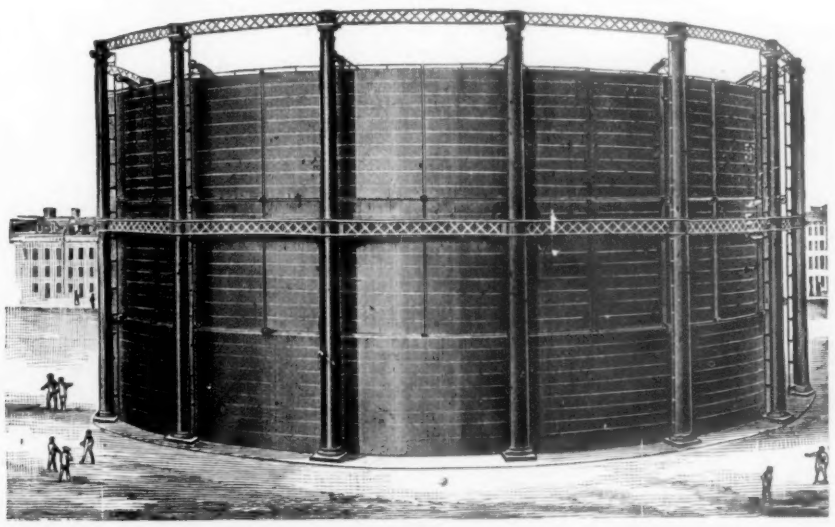

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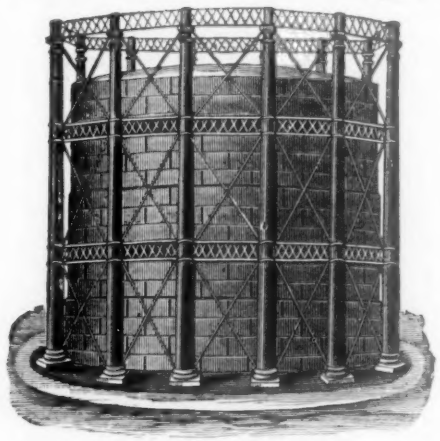

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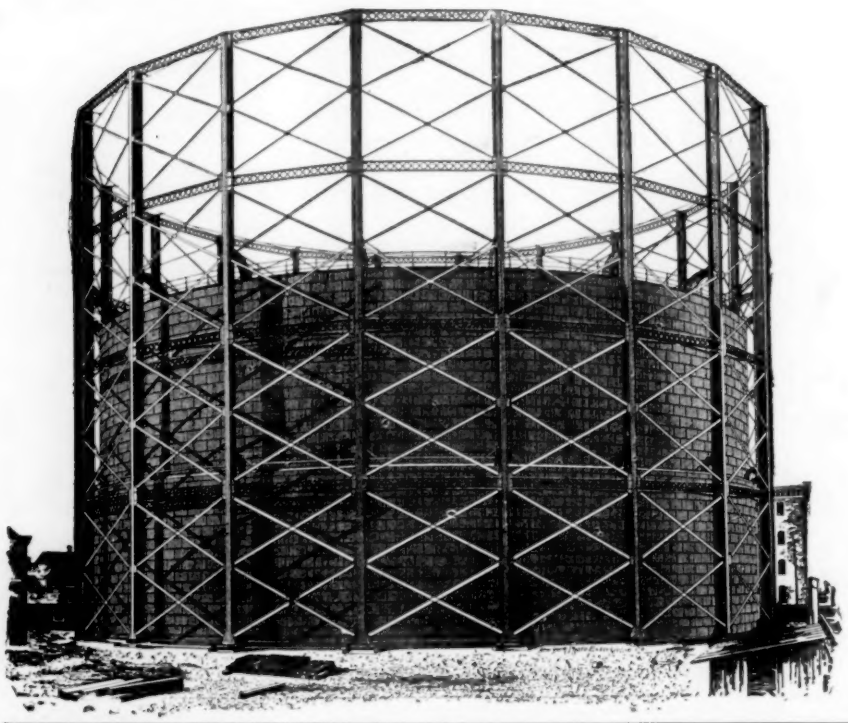

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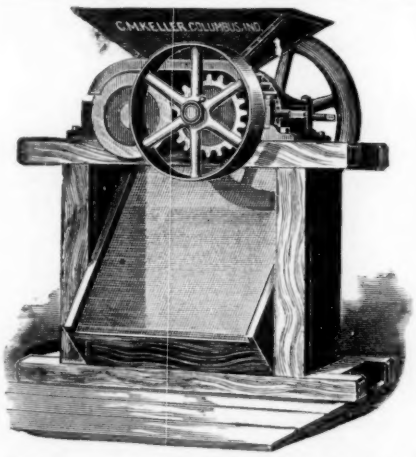

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